IMPORTANT

The aim of this handbook is to answer the many questions you may have about the different aspects of studying for a degree at the University of Strathclyde. The handbook contains practical information about the University, the Department and your course of study including course regulations, class syllabi and departmental procedures. It is an important reference document which will help you to ensure that your time here is organised efficiently and to maximum benefit.

The University of Strathclyde was formed from the Royal College of Science and Technology and the Scottish College of Commerce, and received its Royal Charter in 1964, both former institutions having had long traditions of involvement in higher education. In the case of the Royal College this dates back as far as 1796. Since receiving its Charter, the University has thrived on the John Anderson Campus in the city centre, with four faculties having developed - the Faculties of Engineering, Humanities & Social Sciences, Science and the Strathclyde Business School.

Table of Content

Session 2015/16 - Dates to Note

(up-to-date 'Key Dates' available at http://www.strath.ac.uk/studying/currentstudent/)

Semester 1: 18 September 2015 – 15 January 2016

Semester 2: 18 January 2016 – 27 May 2016

Please note that the University is **closed** on the following dates:

28 September 2015

24 December 2015 to 04 January 2016 inclusive

25, 28 March 2016

02, 30 May 2016

15, 18 July 2016

Graduation Ceremonies *(provisional dates)*

23 June to 01 July 2016 inclusive

NOTE: Students should register for graduation well in advance of graduation day (usually around three months beforehand) and should check the above Key Dates page or notice boards in the McCance Building for specific dates.

Deadline for June/July graduation is 06 May 2016.

Semester 1	
Week No.	**Date Beginning**
1	21 September 2015
2	28 September 2015
3	05 October 2015
4	12 October 2015
5	19 October 2015
6	26 October 2015
7	02 November 2015
8	09 November 2015
9	16 November 2015
10	23 November 2015
11	30 November 2015
12	07 December 2015
Revision Week	14 December 2015
Christmas Vacation	21 Dec'15 – 04 Jan'16
Exam Period	05 - 15 January 2016

Semester 2	
Week No.	**Date Beginning**
1	18 January 2016
2	25 January 2016
3	01 February 2016
4	08 February 2016
5	15 February 2016
6	22 February 2016
7	29 February 2016
8	07 March 2016
9	14 March 2016
10	21 March 2016
11	28 March 2016
Spring Break	04 - 15 April 2016
12	18 April 2016
Revision Week*	25 – 29 April 2016
Exam Period	03 May – 27 May 2016
Resit Exams	**TBC** 03-17 August 2016

*****_Honours exams may fall within w/c 25 April 2016_

Section 1

The Department of Mechanical & Aerospace Engineering

Welcome

From the Head of Department

It is my very great pleasure to extend a warm welcome to new students joining the Department of Mechanical and Aerospace Engineering (MAE) and to welcome returning students back to the department after what I hope was an enjoyable and refreshing summer break. As the returning students will know I am myself new to the department and I am delighted and honoured to be joining such a renowned school of engineering.

Engineering is a fascinating, stimulating and rewarding career. Engineers are always in demand and in a very wide range of settings. Your engineering education will stand you in the best possible stead and open doors in all sorts of organisations or indeed equip you to start one of your own. Modern life has been shaped by engineers and they are always at the forefront when new challenges emerge. I think the 21st century will be replete with challenges as fierce as any society has ever faced and that engineers, as usual, will be in the vanguard. In short, I think it's a great time to be an engineer and to study engineering.

For those of you new to the subject and to studying at university you will find the learning environment rather different to that at school or college. Indeed adapting to studying in a university setting can, at the start, be almost as challenging as the technical content of the programme of study itself. I urge all students to think carefully about how you manage your time and to try and develop effective study methods. If you do and if you approach your studies with diligence, commitment and intelligence, you will build an excellent platform for success both in your studies at Strathclyde and in the fulfilling career that follows. Furthermore, with good time management and study technique there should be ample time for you to enjoy everything that life at university has to offer and I encourage you to do just that!

This handbook will provide you with guidance on the operation of the department and is designed to assist you with your studies and to let you know how and where to seek help should you need it. It gives contact information for all the people in the Department, and details the requirements and regulations for the Department's degree courses. Your Personal Development Adviser and Year Adviser of Studies can help clarify the regulations and requirements and deal with any specific problems you may encounter. You can also get help and advice on specific classes from individual lecturers and class registrars. Please let your Student Representatives know about any persistent issues, and they will convey these to us through regular meetings of the Staff/Student Committee. If you wish to talk to me about any issues, please email Donna Fairley (donna.fairley@strath.ac.uk) to arrange a suitable time for us to meet.

I hope you find the coming academic year challenging, enjoyable and rewarding and I look forward to getting to know you and to working with you.

Prof Andrew Heyes

Hi everyone,

On behalf of the MAESA committee, welcome to the Department of Mechanical & Aerospace Engineering! We're looking forward to meeting all the new students and making your fresher's year the best it can possibly be. For everyone else, welcome back for another year of fun and games!

MAESA is the Mechanical & Aerospace Engineering Students Association. It is run by students, for students who are undertaking courses in the Department of Mechanical & Aerospace Engineering. We are comprised of undergraduate students across all 5 years and we are always looking for more volunteers to help run the committee and organise our events. So if you're looking for a way to be part of the Mechanical and Aerospace community outside of your studies, then get involved with the committee! Being part of MAESA allows you to build on existing skills, develop new ones, gain new experiences, meet new people and above all have fun. Something that potential employers are very interested in.

If you're not up for getting involved directly, you can always support us in other ways. Being a student group, we rely on your involvement to allow us to continue to host great events. So come along to our social events and have some beer and banter with students from all year groups. We'd love to hear suggestions for new events as well, so if you want to see something happen, let us know!

Not only are our events going to be better than ever before but there will be even more of them, as we plan on joining up with the Institution of Mechanical Engineers Glasgow Young Member's Panel. Don't worry; we'll still have our 5-a-side football league, pub quizzes, and our legendary common room parties! But we'll also be promoting some industrial visits with the help of the IMechE GYM. Not only will these provide insight into the engineering industry, but it will give you an opportunity to meet other mechanical and aerospace engineering students from across the whole of Glasgow!

If you have any other suggestions or new ideas, get in touch at maesa.strath@gmail.com.

On behalf of the MAESA committee, have a great year and enjoy yourselves. We look forward to seeing you at our events!

Martin Nolan

MAESA President 2015/2016

e-mail: maesa.strath@gmail.com

People in the Department

PLEASE REFER TO THE UNIVERSITY DIRECTORY (http://but.mis.strath.ac.uk/Teldir/control/search)
or MAE PEOPLE FINDER WEBPAGE (http://www.strath.ac.uk/mae/moreaboutus/)
FOR FULL DEPARTMENT STAFF NAMES AND CONTACT DETAILS.

Departmental academic staff can be found on Level 8 of the James Weir Building.
(please report to Central Services Reception on arrival prior to meeting staff)

Head of Department: Prof Andrew Heyes

Deputy Head: Prof David Nash

UG Course Director: Dr Ian Taylor

Director of Education / PDS Co-ordinator: Prof James T Boyle

UG Administrator: Mrs Donna Fairley

See next page for UG Year Adviser information.

Student Support Services

Where to find help

There are numerous support services within the University and these are detailed in the current University Student Handbook which is issued to all new students and can be found on the University's Student page at http://www.strath.ac.uk/student/.

In this section of the Departmental Handbook, we explain where you can find support within the Department of MAE.

Course Director and Year Advisers

There is an Adviser of Study for each year of your course, in addition to the UG Course Director. The aim of the Adviser is to counsel you on aspects of your current year (in particular academic queries) and to assist you in choosing optional subjects to study.

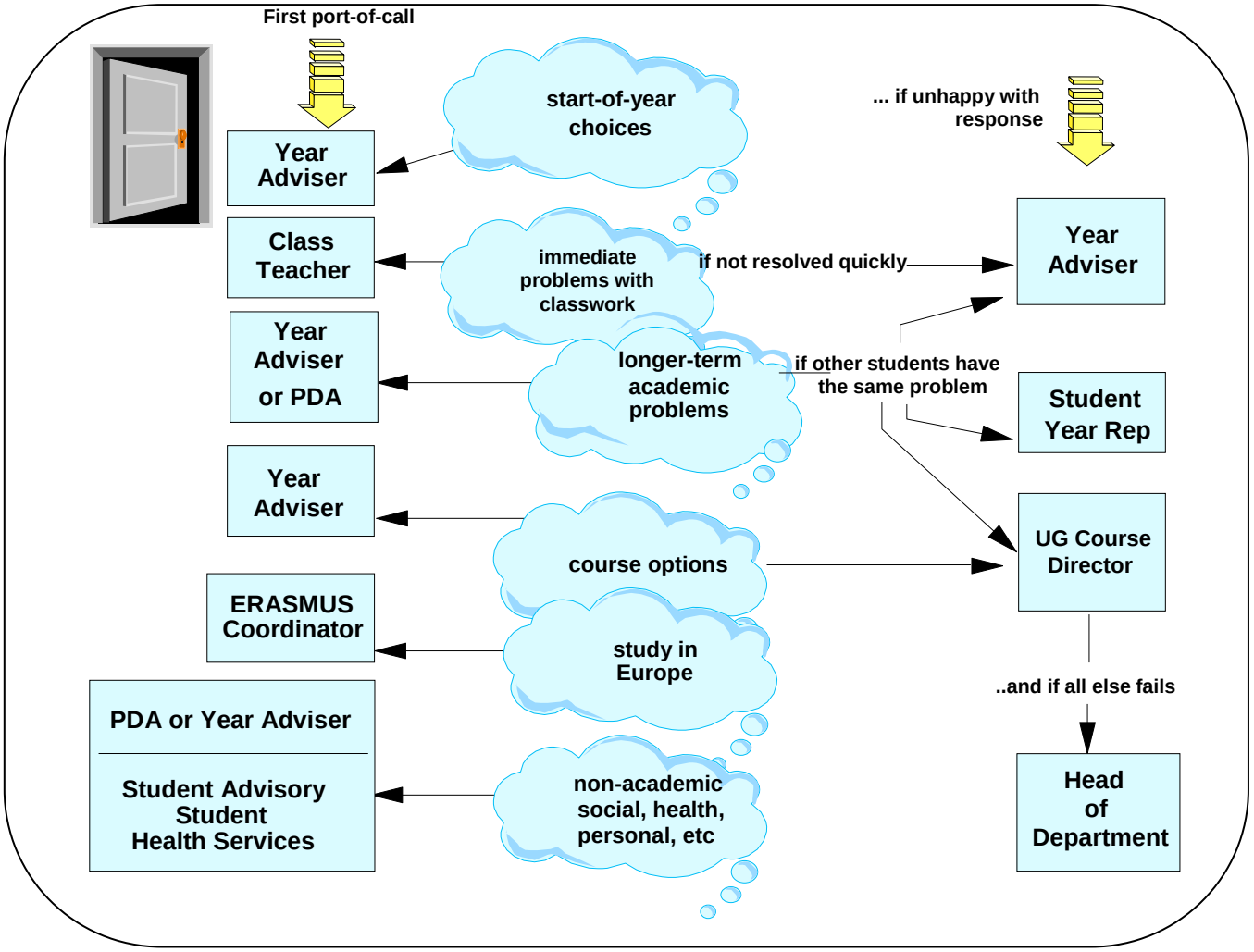
First Year Adviser	Prof James T Boyle	Ext 2311
Second Year Adviser	Dr Barbara Keating	Ext 5068
Third Year Adviser	Mr Cameron Johnstone	Ext 3788
Fourth Year Adviser	Dr Marcus Wheel	Ext 3307
Fifth Year Adviser	Dr Mónica Oliveira	Ext 5060
Course Adviser (Mechanical)	Dr Ian Taylor	Ext 3753
Course Adviser (Aero-Mechanical)	Dr Matthew Stickland	Ext 2842
UG Course Director (all programmes)	Dr Ian Taylor	Ext 3753

Staff-Student Liaison Committee (SSLC)

A Staff-Student Liaison Committee, which normally meets twice per year, provides a forum where academic problems may be raised by student representatives. Students are encouraged to consider the benefits of becoming a Student Rep, further information on which can be found from the USSA at www.strathstudents.com.

Departmental Student Reps are encouraged to run the SSLC, which normally comprises two reps from each year, the Director of Education, Year Advisers of Study plus senior members of staff or others as appropriate. When selected, the names of reps will be notified via email. If there is an issue which is important to a large number of students and you believe should be discussed at this Committee, you should inform the Student Rep for your year so that it can be placed on the agenda for the next meeting. However, before the issue is brought to the meeting, it is IMPORTANT that it has first gone through the proper 'Problems' channels which follow. Only once there has been no satisfactory resolution of a problem should it be brought before the SSLC.

Problems? - Where to go



Disability Service

For information on this service please refer to the University Student Handbook found on the University's Student page at http://www.strath.ac.uk/student/.

Prof James Boyle is the Departmental Disability Coordinator/Contact.
Donna Fairley is the Department's Examinations Coordinator for students with disabilities.

If you believe that you qualify for special examination arrangements, then you must ensure you visit the Disability Service (see http://www.strath.ac.uk/disabilityservice/).

NOTE: any special arrangements must be in place several weeks prior to the start of examinations.

Educational Policy

Course Aims and the Learning Experience

Your aim in choosing your degree course is undoubtedly to graduate and qualify as a competent professional engineer. Our aim is to assist you in the best ways we can to achieve that goal. There are various elements of knowledge, skills, experience and understanding which are to be found in competent engineers and your course will give you the opportunity to acquire and develop these. By the end of your course, we expect that you will:

- have a good working knowledge of the fundamentals of systems and processes which are generally recognised to be in the domain of mechanical engineering and its related subjects;
- be able to understand, model and predict the behaviour of engineering artefacts through the application of scientific and technological principles;
- have had a great deal of practice in creating new solutions, adapting old ones, and in using your acquired knowledge in materials, energy systems, manufacture and computer-aided design techniques.

We also expect you to develop many new capabilities which are not simply concerned with engineering technology; in fact we will be disappointed if your outlook does not change radically during your course. In particular, we expect that you will:

- continue to develop the capacity you already have to learn about many things - a good engineer can do anything;
- increase your skills in communicating and working effectively with others - engineers work in teams and lead teams;
- grow to understand your place as an engineer in a complex and fascinating professional community - the world is your oyster.

Student Charter

Departmental staff aim to:

- be responsible and responsive in all matters related to students
- respect individual students as partners in the learning process
- maximise learning opportunities
- minimise bureaucracy and ensure the transparency of procedures
- maintain a friendly and caring environment
- operate an efficient information system
- identify clearly the responsibilities of staff and students
- facilitate innovative developments where appropriate
- ensure equality of opportunity for all

Assessment and Feedback

The Department fully subscribes to the approach to Assessment and Feedback stated by the University, http://www.strath.ac.uk/learnteach/informationforstudents/students/assessfeedback/ and elucidated in the 12 Principles of Good Assessment and Feedback, http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/.

Accordingly, assessment and feedback methods used by each class are explicitly stated in the associated Module Descriptor Form (MDF). The most up-to-date MDFs can be found at http://www.strath.ac.uk/mae/currentstudents/. The Department also recognises that, in addition to constituting a formal response to assessment, feedback also incorporates informal communication between staff and students (either individually or collectively) that provides information on progress and performance. This implies a more bilateral process in which students are encouraged to seek feedback by actively engaging with staff as appropriate.

Engineering Profession

All courses in the Department are designed to lead to Chartered Engineer (CEng) status, in that they are accredited by one or more of the professional institutions in the Council of Engineering Institutions. It is your responsibility to exploit this benefit, although staff here will be pleased to help you with advice, form-filling and so on.

The paths to CEng registration are given in an Engineering Council publication – UK SPEC - which defines the initial education required and the subsequent stages of education, training and experience needed to achieve full membership. For those students who entered courses in 2000 or later, the MEng courses provide the only direct route to Chartered Engineer status, without further academic study. BEng (Hons) courses fulfil the CEng requirements in part, but graduates of these courses will require, under current Engineering Council rules, to complete a so-called ‘Matching Section’ of further study - equivalent to one year of full-time study, approximately.

In any event, you are strongly recommended to begin your own developing association with the professional body you choose by joining up now. It costs little (Student Membership is sometimes free for students on accredited courses). You will keep abreast of changes in UK SPEC and your time as a student will be credited to you when you eventually apply for full membership.

Useful Administrative and Other Information

Central Services / Reception

All general enquiries should be directed in the first instance to Central Services/Reception on Level 8 of the James Weir Building. Student opening hours, which may be subject to change, are:

Monday – Friday: 1000 - 1600

Class lecturers should indicate submission dates for coursework. Where possible coursework will be submitted electronically but failing that it should be submitted to Central Services/Reception during opening hours. The lecturer for each class will provide students with a front page for submitting their coursework. If you do not receive this front page please download one from http://classes.myplace.strath.ac.uk - coursework cannot be handed in without it.

Marked paper coursework submissions can be picked up from student boxes located near JW801.

Access to Buildings out-with Normal Hours

If you wish to access University premises out-with normal hours (0800 – 1800) it is important that you read Appendix 2 of this Handbook. For access to computer rooms it will be necessary for you to have a 'red card' signed by a member of staff in Central Services.

Thereafter the card must be taken for counter-signature to the Information Technology Services (ITS) Helpdesk, level 3 of the University Library.

Normally we can guarantee your obtaining a card if your request is made within Central Services opening hours, but you should be aware that possible staffing situations may prevent this so you should think ahead and not leave it until the last minute or a Friday afternoon.

Students wishing access to laboratories out-with normal hours must complete the form contained in Appendix 2 of this Handbook (also available from the MAE Current Students webpage).

Email Accounts

You should check your '@strath' email account on a regular basis to ensure that you do not miss important announcements. Emails should also be cleared out on a regular basis as communications cannot be received when your account has reached capacity.

References

Frequently companies will ask for referees who can comment on your academic progress as well as on your general conduct. You should ask your Year Adviser or perhaps your Personal Development Adviser to act as a referee; final year students can contact their project supervisor.

The Sir William Arrol Bursary

The above bursary is available to first year students in the Mechanical & Aerospace Engineering Department. The recipient of the bursary will receive £1000 per year for the 4/5 years of their course. All first year students are invited to apply for the bursary via an application form obtainable from Central Services. Completed applications must be lodged with Central Services by the end of November each year.

Use of Computing Facilities and Resources

The University will not permit the use of its computer facilities and resources for access to, or transmission of, information which is considered by the University to be unacceptable; illegal; in breach of university policies, such as those on Equal Opportunities and Harassment; wasteful of resources or not commensurate with the provision of facilities for legitimate educational purposes.

Examples of such unacceptable use may include:

> accessing or displaying pornographic material; stating defamatory opinions or views concerning individuals or organisations; accessing or displaying discriminatory material or material which encourages discrimination; engaging in games or chain E-mail; publishing information which is intended to misinform and thereby causes anxiety or inconvenience to another; unauthorised use of University logos, titles etc; spamming; corrupting or destroying another user's data; violating the privacy of other users; disrupting the work of others; using JANET in a way that denies service to others; misuse of networked resources such as the introduction of viruses.

The University actively monitors usage of the University computer facilities and resources which includes monitoring the access to, publication or receipt of, any Internet materials by any user.

Study Abroad

Please also refer to 'Overseas Study' in Section 2 of this handbook.

General

The Department encourages all suitably qualified students to consider the benefits which foreign study brings to the learning experience. Students who wish to participate in an ERASMUS+ (or similar) exchange are ambassadors for the Department and the University, and should note that it is IMPERATIVE that prior permission, in principle, to pursue study overseas is obtained from both the Year Adviser for the year when they will be overseas (usually the Year 3 Adviser) and the Department's Outgoing Exchange / ERASMUS+ Coordinator, Dr Andrew McLaren.

Normally this will be covered by their signature on the Learning Agreement which has to be completed by all students wishing to study overseas. Only once results are known will this permission be ratified as explained at (c) below.

Those students enrolled on courses which require foreign study as part of the requirements for the award of their degree, should be aware that such study can only proceed where the student has reached an appropriate standard and has a reasonable expectation of benefiting from the experience; if this poses a difficulty it is possible to change to another, related course where foreign study is not obligatory.

For those participating in an exchange programme, attention is drawn especially to the following:

(a) FEES: Do not forget to apply for your fees for the subsequent academic year. You should write to Student Experience in March asking them to send you an application form.

(b) EXAMINATIONS OFF CAMPUS/OUTWITH THE UNIVERSITY: Please see pages 23 & 34.

(c) While the Department encourages students to participate in overseas exchange studies in their third year (and additionally in fifth year), it is important in the case of second year students that, prior to embarking on an exchange programme, certain objectives have been met:

- all first year classes have been passed
- all second year compulsory classes have been passed

This is especially important in the case of non-European exchange studies, not simply from an academic point of view, but also from a practical viewpoint. The large time difference involved in international exchanges makes it difficult (or sometimes impossible) for students to take a resit examination overseas.

While agreement to participate in an exchange programme may be given in principle before the end of the academic year, it is imperative that the student concerned has this agreement ratified **in writing,** by Dr McLaren, as soon as their examination results are known. **Without this ratification no student from the Department of Mechanical & Aerospace Engineering will be considered to have the necessary permission to embark on an exchange programme.** In exceptional circumstances students may appeal to the Head of Department. In the event of a successful appeal, outstanding resits will be deferred until the student's return.

ERASMUS+ - A Student's Guide

What is it?

ERASMUS is the name given to the **E**u**R**opean Community **A**ction **S**cheme for the **M**obility of St**U**dent**S.** It forms a major part of the efforts of the European Union to ensure that graduates within its member countries should be able to function on a Union-wide basis within the single European market.

What is Strathclyde's involvement in it?

The University of Strathclyde (and in particular the Department of Mechanical & Aerospace Engineering) has entered into the scheme in a comprehensive way because it believes firmly in its overall aims.

What does the scheme involve?

The scheme provides a wonderful opportunity for students to spend part of their degree course at a university in another country within the European Union. This study elsewhere counts as a normal part of the degree curriculum. The various schemes have therefore been designed to ensure complementarity with studies which the student would otherwise have taken if he or she had remained at Strathclyde. Where language permits, students can attend lectures in their European university. Alternatively, for students whose language skills are less well-developed, project work may be undertaken in the host University in collaboration with a supervisor who speaks English.

Credits are awarded for overseas study just as they would be at Strathclyde and are normally awarded at the September Examination Board once transcripts have been received from the partner institution. Since performance in earlier years of the course contributes to the class of Honours, for this purpose, each student will be awarded an overall grade for their period of foreign study which will be agreed between the ERASMUS Exchange Coordinator and the Adviser of Studies.

The minimum length of an exchange is three months and the maximum is a full academic year.

Is language not a difficulty?

The Faculty has recognised that proficiency in another European language is highly desirable for the success of any student exchange. Arrangements have therefore been made with the Language Learning Centre to offer specially designed classes in French. These classes are pitched at different levels to take account of previous knowledge (ranging from nil to passes in Highers). They are normally taught in small groups and aim to teach spoken and written language in an enjoyable and relevant way. These classes are recognised by all courses in the Faculty as "approved elective classes". Classes in other European languages may also be available. During the period of the exchange itself, language tuition is normally provided by the host university. This may include basic classes in languages such as Danish and Swedish. If you think you may be interested in participating in a European exchange programme you should ask your Year Adviser about the elective classes on offer from the Language Learning Centre.

What are the benefits for me?

While the exchanges usually mean hard work when you are there, they can also be enormous fun. Strathclyde students studying in Europe have taken the opportunity to travel, to spend time with students from their European university and sometimes to obtain relevant vacation employment in Europe.

How much does it cost me?

A supplementary grant is provided by the ERASMUS+ Scheme to help towards travel and higher living costs. It should be stressed that this grant is a supplement and not a substitute for your normal funding arrangements. Even although you are studying overseas, it is important to ensure

that you have applied for fees through your normal funding body for the academic year in which you will be spending time overseas, and that you are properly registered, otherwise you will not be eligible for a student loan.

When can I go?

Students presently in second year may opt to spend all or part of their third year abroad; exceptionally it may be possible to spend part of the fifth year overseas. What you do abroad is normally agreed beforehand, and may be a combination of lectures, labs and project work, depending upon the courses on offer and your facility with languages. All MEng students are expected to consider going abroad at some stage during their course. This is an essential element in their personal development.

There is much to be said for starting your time abroad in semester 1, if possible, since you can go early enough to check out the social scene, lecture schedules, etc, before classes start. If you want to pursue classes in Germany, you may need to go in semester 2 - project work can be carried out in either semester. Studying abroad for the whole year is by far the most beneficial and is an absolute must for France.

How do I find out more?

Almost all you need to know about ERASMUS+ can be found at http://www.strath.ac.uk/rio/exchangestudyabroad/goingabroad/erasmus. This gives links to our partner institutions. Student Grant Contract forms and the Learning Agreement mentioned above may be obtained from MAE Central Services. The deadline for completion of both of these forms is **30 April**.

Further information on European exchange arrangements is available from the Department's Outgoing Exchange / ERASMUS+ Coordinator Dr Andrew McLaren andrew.mclaren@strath.ac.uk.

The Course

General Course regulations are published on the University web-site at:
http://www.strath.ac.uk/sees/educationenhancement/qualityenhancement/universityregulations/

Core Curriculum

The Department of Mechanical & Aerospace Engineering courses are organised through a number of principal themes depending on which course is undertaken e.g. Materials/Engineering Manufacture and Design, Mathematics and Computer-Aided Engineering, Engineering Science and Applications, Professional Management Studies.

For example, fundamental topics which underpin the practice of mechanical engineering develop through the themes of Mechanical Engineering Science and Applications. Mathematics and Computer-Aided Engineering studies provide competence in the use of modern, analytical IT tools; appreciation of Materials, Manufacture and Design complements the base of fundamentals. More specialised topics relating to the degree in Aero-Mechanical Engineering have an increasing presence after the second year. The individual topics are progressively integrated over the duration of the courses, Engineering Design being the unifying theme in the third year. In the fourth year, the skills, knowledge and understanding developed earlier are brought to bear on a practical project. Specialised studies, in particular Engineering subjects and a Computer-Aided Engineering class based on industrial software, round off the final years of the course.

Engineering is pursued within a Business climate and the theme of Professional and Management Studies is an essential ingredient of preparing to operate as a competent engineer.

4/5 Year Course Structure

The MEng provides the opportunity for students of above-average ability to enhance their studies in alternative ways. For example there are Masters level classes in a wide variety of Engineering topics but it may also be possible to take classes from the extensive portfolio offered by the Strathclyde Business School. Popular Business classes include Accounting and Financial Management.

The main reason for most students to pursue the 5 year MEng option is to complete the educational requirements for Chartered Engineer status before graduating and therefore to avoid the need to return for further study at a later stage. The option to graduate after four years with a BEng Honours award is open to all students and many employers traditionally take on such graduates with a view to further in-house training which may also provide a route to Chartered status. However, current experience is that such employers look for a good class of degree and evidence of a well-rounded portfolio of achievement.

Transfer between Courses

The Department operates a policy which allows students to delay final degree choices until their career aspirations have been determined. Normally such transfers can be delayed until the start of the third year of the course.

It is normally possible to transfer from the BEng course to the more demanding MEng stream. To transfer to (and remain on) the MEng stream, students must achieve a credit weighted average (CWA) of 60% or above for their curriculum in an academic year. Any student who may wish to consider such a transfer should seek advice from their Year Adviser.

Such students should note that in addition to meeting the progress Regulations, transfers require the approval of the Board of Examiners. This approval will readily be granted provided that a student has achieved the necessary 60% or above CWA for the academic year. Conversely, students registered on the MEng courses will be required to transfer to the BEng stream if their performance is not at the required standard (i.e. those with a CWA of lower than 60%). Further

advice on all such transfers may be sought from the Course Director.

Note that it is also possible to change courses between the major discipline areas such as Mechanical, Aero-Mechanical and Mechanical Engineering with International Study. Such major changes are usually only possible in the earlier years of the courses. Changes at the end of first year usually present few problems (although are conditional on satisfactory progress). Major changes of direction become progressively less viable if delayed. If in doubt, take advice from the Director of Education.

Course Regulations - Guidance Notes

You are encouraged to consult the Regulations governing your course on a regular basis. The Regulations set out the framework for your studies and specify the criteria for your progression through the course. The language is carefully chosen to cover all eventualities and may need some interpretation or clarification. The following notes do not stand in place of the Regulations but are merely intended to explain the terms used or the thinking behind the text.

There are two main streams; MEng and BEng Honours. The MEng course is intended for high achievers and can be expected to be challenging. It is a five year course. The curriculum is mainly common with BEng in the early years but different progression and award criteria may apply. You should make yourself familiar with all of these.

Registration/Curriculum Choice

Please note that it is your responsibility to ensure that you are registered correctly. If you take a class but have not registered officially for that class you will not be awarded the credits. Conversely, if you register for a class then do not take it, you will be recorded as having failed unless you delete the class from your record before the curriculum change deadline.

1. The standard curriculum for full time undergraduate students is 120 credits per academic session.
2. Exceptionally, an extra 20 credits per year may be taken, subject to approval of the Course Director.
3. Compulsory classes cannot be substituted, and where additional optional classes are taken, the overall mark will be based on performance in all classes attempted.

Coursework

Try hard to keep up with your coursework - it is important. If you miss the deadlines without satisfactory reasons, you may find that your assessment for that class is heavily compromised. Only you can judge if you can afford to lose marks which might affect either your progress on the course or your final assessment. It should be noted that penalties may be incurred for late coursework. In any event, all coursework should be submitted not less than 3 weeks prior to the relevant Examination Board.

Progress

Progress on the different streams is based on the accumulation of credits for which the pass mark is normally 40% (note: level 5 subjects require a pass mark of 50%). This is the minimum acceptable for credit accumulation; however, it is important to note that students on Honours and Masters courses are expected to perform at a substantially higher level.

To progress to the next year of the MEng Degree course, **a credit-weighted average (CWA) of 60% minimum is required**. If a student's CWA drops below 60%, they will be moved by the Examination Board to an appropriate BEng Degree programme, provided all other progress requirements have been satisfied. It is important to understand that, at the end of fourth year, if appropriate, failure to maintain this standard can result in the requirement to transfer from MEng to BEng and graduate immediately.

Award of the degrees

It is important to understand that your performance in the earlier years of your course can have a bearing on your final award. This means that continued high performance will be rewarded but with emphasis on the later stages of the course. You should also be aware that, in line with recommendations of the accrediting institutions, the performance to be taken into account is based on **first diet assessment**. The mechanism for calculating your final marks is given below.

Mechanical Engineering

BEng

Composition of final mark:	15% of Year 2 mark 25% of Year 3 mark 60% of Year 4 mark
Year 2*:*	Credit Weighted Average of first attempt at compulsory credits.
Year 3:	Credit Weighted Average of first attempt at compulsory credits. External study has been assigned a mark.
Year 4:	120 credit curriculum: Honours mark composed of 25% of the Y4 Individual Project (ME409/ME420) plus 75% of credit weighted average of remaining compulsory credits. 120 + credit curriculum: Honours mark composed of 25% of the Y4 Individual Project (ME409/ME420) plus 75% of credit weighted average of remaining compulsory and elective credits.

MEng

Composition of Final Mark:	15% of Year 2 mark 25% of Year 3 mark 60% of Year 4/5 mark
Years 2 and 3:	As BEng
Year 4/5*:*	Credit Weighted Average of **all** credits taken over Years 4 and 5, including compulsory credits.

BEng/MEng (following direct entry to 3rd year)

Composition of Final Mark:	25% of Year 3 mark 75% of Year 4/5 mark
Year 3:	As BEng
Year 4/5:	Credit Weighted Average of **all** credits taken over Years 4 and 5, including compulsory credits.

Classification of awards

The Honours bands may vary slightly from year to year at the discretion of the Final Honours Examination Board on the advice of the External Examiner. To let you know what to aim for, the bands will normally be of the order of:

BEng	1st	≥ 70%
	2.1	60-69%
	2.2	50-59%
	3rd	40-49%
MEng with Distinction		≥ 70%
MEng with Merit		60 – 69%
MEng		50 – 59%

Proctoring/Second year project elective

A scheme exists whereby second year students may choose a ten credit project elective which involves assisting final year project students. This enables the final year student to gain experience in managing and supervision while the second year student gains an insight into the final year project requirements. Students are strongly encouraged to consider this option.

Engineering Applications (EA)

Engineering Applications provides an opportunity to acquire experience of practical engineering, and completion of this credit is a requirement for chartered status. All new students to the Department will undertake EA in two phases - Level 1, comprising mainly workshop practices in the first year and Level 2 comprising mainly practical test work in the second year.

Students will be provided with dustcoats, safety glasses and protective footwear. They should bring with them an A4 ring binder with paper for notes which will later be entered in a Log Book. Female students are advised to wear jeans if possible. Students are required to attend and perform all the designated elements of EA in order to obtain a satisfactory report and a corresponding credit which is awarded at the end of second year.

Examinations (General information)

It is important to note that:

- students **MUST** be available for exams during all of the exam periods/diets and should therefore not book any holidays that fall into these periods. Published exam dates may change and therefore **you must not make arrangements to leave the area prior to the official end of the examination period**. No special arrangements will be made in such cases.

- students will normally be given two attempts to pass classes during the course of the academic year. Students who fail to complete a class at the first attempt will be given one additional assessment opportunity before the September Board of Examiners. This will either be a re-submission of coursework or a formal examination in the August diet (as detailed in the class Module Descriptor Form). **For the purposes of degree classification, first diet marks will be considered.**

- those who are permitted to carry over classes to subsequent years will be given the opportunity to resit them during the course of the next academic year. Students should note that failure to pass any compulsory class after four attempts will result in withdrawal from the degree. **NOTE: for Level 4 and 5 classes, only ONE resit attempt is allowed (two attempts in total).**

Please check the Student Experience and Enhancement Services (SEES) webpage http://www.strath.ac.uk/exams/ for further examination information.

External Examiners

Dr Robert Cripps (Deputy Head of School/Head of Learning and Teaching), from the School of Mechanical Engineering, University of Birmingham is currently External Examiner for:

Mechanical Engineering
Mechanical Engineering with Financial Management
Mechanical Engineering with International Study
Mechanical Engineering with Materials Engineering

The new External Examiner for the following courses is to be confirmed:

Mechanical Engineering with Aeronautics
Aero-Mechanical Engineering

Students must <u>not</u> contact External Examiners with queries against an academic decision. You should contact the Department for feedback or submit an appeal at the appropriate time as per the Personal Circumstances and University's Academic Appeals Procedure.

Use of calculators

It is recommended that students have a basic scientific calculator for use in examinations as, although calculators may normally be taken into the examination venue, they must not be used to store text nor formulae nor be capable of communication. Invigilators may require calculators to be reset. **MOBILE/SMART PHONES CANNOT BE USED AS CALCULATORS DURING EXAMS**.

Use of dictionaries

Regulations state that students whose native language is not English are permitted to use paper-based English/native language dictionaries in University examinations. These dictionaries will be subject to scrutiny by the Invigilator in charge of each examination. Electronic dictionaries are not permitted in University examinations. Regulations state that, unless instructions have been issued to the contrary, dictionaries shall not be used in language examinations.

Pass mark

Normally the pass mark for each class is 40% unless otherwise notified (NB: level 5 subjects require a pass mark of 50%). However there are a number of reasons why you should set your sights higher than this, not least being the fact that your marks will appear on your Academic Transcript, copies of which are often sought by prospective employers. In addition, where the classes contribute to the grading of your final degree classification, it is important for you to secure the highest possible marks. Students in their first, second and third years, and fourth year (MEng only) who perform well, will be rewarded by the award of a Dean's Certificate for meritorious performance. In addition to this, a number of other prizes are awarded each year to top students.

Requests to sit Examinations off-campus

Your attention is drawn especially to the following:

All students are expected to attend for examination at the University of Strathclyde on the dates and times scheduled. Only EXCEPTIONALLY will permission be given for students to sit examinations out-with the University.

Such an exception may be:

- when a student who is participating in an exchange programme has to take a University of Strathclyde examination while at the exchange institution

Permission will NOT be granted in the following cases:

- if a student wishes to leave the University prior to the end of the examination period
- where a student has a resit examination (all students must attend resits in Glasgow in person)

Where necessary, requests to take an examination at a BONA FIDE institution other than this University (normally one of our overseas exchange institutions or a British Council Office) should be formally made in writing via the appropriate Year Adviser.

This request must be made no later than SIX WEEKS prior to the start of the examination diet. Once permission, in principle, has been granted you must thereafter arrange for written communication to be sent by an authorised person at the proposed examination site confirming that the institute is prepared to act for the University of Strathclyde in this matter and giving a contact name, telephone number, e-mail address and full postal address. **NB: Post box addresses are not suitable as exam papers will be transported by courier.** This written communication must reach your Year Adviser no later than FOUR WEEKS prior to the start of the examination diet. Your request and the statement from the "authorised person" mentioned above are then sent by the departmental Examination Co-ordinator to the Director of Professional Services from whom formal approval must be obtained. **Examination papers cannot be sent abroad unless the above procedure has been followed.**

For all MAE classes with codes beginning "16" and "ME" the MAE Examination Co-ordinator is:

Donna Fairley, donna.fairley@strath.ac.uk

Names of Examination Co-ordinators for other Departments may be obtained from the 'Students' section on the Disability Service webpage http://www.strath.ac.uk/disabilityservice/ or from the relevant Department.

You should also note that you will be liable for all expenses incurred and fees charged (if any) by the overseas institution.

Students who choose to make travel arrangements (such as purchasing non-flexible/changeable airline tickets) prior to receiving official results at the end of the academic year, must return to the University of Strathclyde in Glasgow during the resit diet to carry out examinations on campus for any failed classes.

Please also refer to the 'Examinations Outwith the University' paragraph in the General Information section of this handbook.

Section 2

The Faculty of Engineering

The Faculty of Engineering

The Faculty of Engineering is one of the UK's leading centres of engineering education. It is the largest in Scotland, and among the largest in the UK, and has achieved the highest ratings in official assessments of teaching quality and research. In addition to links with the Research Councils and the professional Engineering Institutions, the Faculty is renowned for its close links with industry. Industrial contacts are a major influence on both research programmes and taught courses, helping to keep the Faculty's academic staff at the forefront of their subjects.

OFFICE BEARERS

Executive Dean	:	Professor Dimitris Drikakis Mechanical & Aerospace Engineering
Vice-Dean (Academic)	:	Dr Andrew McLaren Mechanical & Aerospace Engineering
Vice-Dean (Knowledge Exchange)	:	Professor David H Nash Mechanical & Aerospace Engineering
Vice-Dean (International Recruitment & Development)	:	Dr Alex M Galloway Mechanical & Aerospace Engineering
Vice-Dean (Research)	:	Professor Zoe Shipton Civil & Environmental Engineering
Faculty Manager	:	Dr Gayle Wilson
Faculty Officer (Academic)	:	Mrs Gabrielle Weir

The Faculty is made up of 8 academic departments:

Architecture	Biomedical Engineering
Chemical and Process Engineering	Civil and Environmental Engineering
Design, Manufacture and Engineering Management	Electronic & Electrical Engineering
Mechanical & Aerospace Engineering	Naval Architecture, Ocean & Marine Engineering

General Information

General Course regulations are published on the University web-site at:
http://www.strath.ac.uk/sees/educationenhancement/qualityenhancement/universityregulations/

Academic Policies and Procedures are published on the University web-site at:
http://www.strath.ac.uk/staff/policies/academic/

Absence & Personal Circumstances

The following procedures and regulations relating to absence through illness should be noted:-

- Students must sit all terminal tests and examinations unless prevented by illness in which case a medical certificate must be produced.

- Failure to attend due to being "unaware of the dates or times or submission deadlines" of examinations and missing an examination due to "misreading the timetable or oversleeping" will not be considered as valid reasons for non-attendance and an 'Absent' will be recorded (see the Personal Circumstances policy).

For all absences, students should record a self-certification online via PEGASUS using the Personal Circumstances link under the services tab.

For long term absences (e.g. >7 days) or for absences where performance in assessments (examinations / courseworks) have been affected, the student is required to submit a medical certificate (signed by a medical practitioner who is not a member of the student's family) to Student Business. Student Business will inform the relevant Department and, if the absence continues for 14 days or more, the SAAS or relevant grant awarding body.

In particular for absences that affect a student's performance in examination(s) or other assessment(s), Personal Circumstances should be notified to Student Business ***within five working days*** of the latest affected examination/assessment or date of submission of affected assessment. In these cases, self-certification is not sufficient and documentary evidence is required.

Students whose performance has been, or will be, affected by circumstances that are acute, severe and outside their control should inform the University **as soon as they are aware of these circumstances**, by recording them on Pegasus under 'Personal Circumstances' and submitting **supporting documentary evidence** as soon as such evidence is available. Students should clearly state the extent, duration and nature of their Personal Circumstances and how these circumstances affected their performance.

The following relating to storage and personal circumstances should also be noted:-

The University provides access to cloud-based storage which students can use to back up their files. Students are expected to back up work and we advise that this should not be on a memory stick or external hard drive only, as these can be stolen along with the laptop during a break-in, eaten by pets, flushed, etc. We therefore strongly advise students to use an online storage system which provides appropriate protection of data.

The University provides an optional storage service called One Drive which is available to students. This cloud-based storage allows users to store up to 1 terabyte of content online. Full details of how to access this can be found at: http://www.strath.ac.uk/ithelpdesk/helptopics/email/office365/. This link points students working with Office 365 email to the optional One Drive which is similar to Dropbox.

The University Personal Circumstances and Academic Appeals Procedure does NOT accept computer failure and lack of back up as grounds for discounting attempts or appealing.

CIRCUMSTANCES THAT WILL *NOT* BE CONSIDERED

Students should note that PCBs (Personal Circumstances Boards) will not consider circumstances which students are expected to cope with as part of a properly managed workload or would not normally have a significant impact on academic performance. PCBs will also normally disregard circumstances which the student could reasonably have avoided, where the student could have taken measures to reduce their impact or are no different from the circumstances facing a significant number of other students. The following are examples of circumstances which would ***not*** normally be considered:

- Inadequate planning to cope with last-minute delays and missing deadlines because of computer difficulties, or transport difficulties;
- Losing work not backed up, failure of a single data source;

In considering examination results and progress requirements, the Board of Examiners is concerned to take into account medical or other circumstances which may have adversely affected a student's performance. If a student does not submit Personal Circumstances via Pegasus, they will not be considered by the Exam Board.

In **NO** cases will a notification of Personal Circumstances be accepted after the Personal Circumstances Board has met, and students may not appeal if they fail to report circumstances prior to examination boards. Students should provide information on adverse circumstances both to their Adviser of Study and to Student Experience. They may also find it useful to arrange to see their Personal Development Adviser.

Please refer to the University's Personal Circumstances & Academic Appeals Procedure on the Academic Policies and Procedures webpage provided above for more information.

Academic Dishonesty *(read in conjunction with University Regulations)*

The University regards academic dishonesty as a serious matter and it can, in some cases, lead to formal proceedings being brought against a student under the University's Student Discipline Procedure. As such, it can carry heavy penalties and it is therefore important that you are aware of what is expected (or not expected) of you as part of the academic community and about what constitutes academic dishonesty. Examples of Academic Dishonesty are given below.

Cheating in written exams:

- Illicit copying and communicating;
- Possession of prohibited materials
- Unapproved use of electronic devices (e.g. smart phones, tablets) to store and retrieve information

False candidature or impersonation:

- Impersonating another student in an examination or engaging someone else to take one's place in an examination;
- Undertaking a piece of coursework for another student or engaging someone else to undertake a piece of coursework in one's place

False declaration:

- Making a false declaration in order to retrieve special consideration by an Examination Board/Committee or Appeals Committee or to obtain extensions to deadlines or exemption from work.

Fabrication or falsification of data/experimental results/statistics/references:

- Presentation of data, experimental results, statistics or references in laboratory reports, essays, projects, presentations, dissertation, theses or other assessed work which have been invented or altered by the student

Plagiarism:

- Using someone else's work (ie words, ideas, results, tables or diagrams) whether taken from print, electronic or internet sources without acknowledging whether by direct copying, paraphrasing or summarizing.

Duplication:

- Submitting the same piece of work for two different assignments/degree programmes – even though it is the student's own work which is being reproduced this is a form of plagiarism and should be treated as such.

Collusion:

- Agreeing with another student either to submit work produced collaboratively or to copy the other student's work. This is a form of plagiarism in which the individual whose work is being plagiarised gives consent for this to happen. In such cases both parties are committing an offence.

Academic Appeals Procedure

Procedures for academic appeals to Faculty and Senate Appeal Committees may be found in University Regulations set down in the Calendar and Faculty guidelines – refer to the links provided at the start of this General Information section. The grounds for appeal are given below.

Appeals against a decision of a Board of Examiners must be made on at least one of the following grounds: **(Please note**: evidence should be provided for all grounds cited.)

- procedural irregularities in the assessment process (including alleged administrative error which could have led the Board of Examiners to reach a different conclusion to that which they might have reached had the error not been made);
- inadequate assessment, prejudice or bias on the part of the examiners; and/or
- You were adversely affected by illness or other relevant factors, of which you were previously unaware, or which for a good reason you were unable to disclose to the examiners in advance.

Any such appeal should be submitted in writing to the Faculty Manager by the deadline stated in the formal examination results letter. Appeals submitted after the appropriate deadline will not be considered unless there are compelling reasons for missing the deadline and these are explained in full and accompanied by the relevant evidence at the time of submission. Appeals received twelve months or more after the date of the relevant Board of Examiners will not be considered in any circumstances.

Students have the ultimate right of appeal to Senate.

Attendance and Performance

Your attention is drawn to the following taken from the University's General Regulations, which can be found at the link provided at the start of this General Information section.

> Every applicant admitted to a course of study shall be required to attend regularly and to perform satisfactorily the work of each class in their curriculum.
>
> Students have an obligation to inform the University Student Experience – Student Business at the first reasonable opportunity of any medical or other circumstances which might adversely affect their attendance, performance and/or ability to study.

A student who, in the opinion of the Head(s) of the Department(s) (or nominees(s)) offering a class, does not satisfy the requirements as to attendance and to performance and having been informed in writing, shall not be entitled to take the examination in the subject of that class. The names of such students shall be reported immediately to the relevant Board of Study.

A registered student may subsequently be permitted by the Head of Department to take the examination in the subject of the class at the next available opportunity subject to satisfactory completion of appropriate coursework.

These regulations will be applied to all Engineering classes (this includes laboratories, design classes, works visits, etc., as well as formal lectures and tutorials). Staff responsible for each class will monitor attendance as appropriate.

The regulations are emphasised for the simple reason that they are in the students' interests. Poor attendance makes the course more difficult for you and is usually associated with poor performance. If a student has to miss classes for any good reason (medical, domestic, etc) he/she must inform their Year Adviser in writing.

We do not interpret **regular attendance** as necessarily meaning 100% attendance. An **occasional** missed lecture, for example, is not a problem. Staff responsible for each class should make it clear if your attendance is heading towards a problem.

Change of Address

Students are required to notify Student Experience of any change in your permanent home or term-time addresses. Student Experience can send several letters to each undergraduate student every year. It is therefore important that they have the correct home and term-time addresses. Students can update their personal details on the University website http://pegasus.strath.ac.uk.

Personal Development Scheme

A student Personal Development Scheme exists within the Faculty of Engineering, the objectives of which are to create an environment where students are able to discuss freely and in confidence any academic or personal matter. Staff can provide advice either personally or, if the student is agreeable, through another specialist member of staff. Few students encounter substantial difficulties but for those who do it is hoped that the scheme will ensure their academic welfare and encourage satisfactory progress with their studies.

The success of the scheme depends on the participation of both staff and students. Students are encouraged to see their Personal Development Adviser at least once every semester, even if only to confirm that all is well.

Those who cannot speak freely to the member of staff assigned to them are invited to approach Prof Boyle, the Coordinator of the Personal Development Scheme for MAE. If this is impractical, students should approach the Faculty Manager, Dr Gayle Wilson (Royal College Building room RC525, Ext 2364).

Equality and Diversity

The University of Strathclyde is committed to achieving and promoting equality of opportunity in the learning, teaching, research and working environments.

We value the diversity of our students and support the development of mutual respect and positive relations between people.

The University has in place an Equality Policy, Disability Policy and Equality Outcomes which meet the requirements the Equality Act 2010. You are advised to familiarise yourself with the University approach to equality and diversity and relevant developments and information by visiting the website at www.strath.ac.uk/equalitydiversity/equalityinformationforstudents/.

It is important that you understand your rights and responsibilities. Any discriminatory practice, including cyber bullying, on your part may lead to the University initiating disciplinary action.

If you have any queries please bring these to the attention of staff or the University's Equality and Diversity office (www.strath.ac.uk/equalitydiversity/).

Email: equalopportunities@strath.ac.uk
Telephone: 0141 548 2811

Athena SWAN

The University currently holds a Bronze Athena SWAN award, recognising our commitment to advancing women's careers in science, technology, engineering, maths and medicine (STEMM) employment in academia.

The Athena SWAN Charter has been developed by the Equality Challenge Unit to encourage and recognise commitment to combating the under-representation of women in STEMM research and academia.

If you would like any additional information, please contact the Equality and Diversity office.

Students with disabilities

The University is committed to providing an inclusive learning and working environment for disabled people.

If you have, or think you have, a disability we encourage you to disclose it as soon as possible. Declaring your disability will enable you to access any additional support that you may need and help to ensure you become a successful student. The information you provide will be treated as confidential and will not be shared with other staff without your consent.

The University has a dedicated Disability Service that offers specific advice, information and assistance to disabled students, including information on the Disabled Students Allowance (DSA). Further information is available from the website: www.strath.ac.uk/disabilityservice/.

In addition, each academic Department/School (for HaSS) has at least one Departmental Disability Contact (DDC), who act as a first point of contact for disabled students. The Departmental Disability Contact list is available on the website at: www.strath.ac.uk/disabilityservice/ddc/.

Please inform your course tutor, the DDC and a member of the Disability Service of your needs as soon as possible. The Disability Service will then formally communicate your needs to your Department/ School.

Email: disabilityservice@strath.ac.uk
Telephone: 0141 548 3402

Issues with Physical Access on campus

If you experience an issue with physical access anywhere on campus, please email: physicalaccess@strath.ac.uk where a member of Estates staff will be able to help.

Classroom Protocol

At the University we are committed to providing a safe learning environment where dignity is respected and discrimination or harassment, including cyber bullying does not occur on the basis of age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity,

race, religion or belief, sex, sexual orientation and socio-economic background. No student should intentionally be made to feel threatened or excluded from class participation.

You are reminded of your responsibility to show respect to fellow classmates and staff by remembering the following protocol for the duration of your studies:

- Attend all scheduled lectures/ seminars and/ or practical sessions such as labs, including any additional learning and teaching sessions.
- Arrive on time and remain in class until the end of the session. If you need to leave early for any reason, please notify the tutor at the beginning or prior to the class.
- Do not disrupt the class by habitually coming in late or coming and going from the classroom during the session. Students arriving late, without justified reasons, may be refused entry.
- Refrain from consistently interrupting another speaker and listen to the ideas of others with respect. Do not be rude or make personal attacks on individuals during group discussions.
- Inform and establish consent of the tutor if you wish to record the lecture. The recording must be used only for personal study.
- Do not bring food into the classroom, other than for medical reasons, e.g. diabetes. Beverages may be permissible at the tutor's discretion if the room utilisation rules allow.
- Inform tutors of specific requirements for example the need to perform prayers for practising students of diverse faiths.
- Seek consent of students and staff before taking any photos, audio or visual recordings in the classroom. These must not be shared on any social network sites without permission.
- At any course related external visit you are acting as ambassadors of the University and are reminded to act as such.
- Refrain from smoking on premises as this is prohibited in all University buildings.
- Follow emergency instructions and health and safety procedures.
- Should you have any concerns please bring them to the attention of your tutor and/ or appropriate University staff.

Examination Information

Examination Boards

There are two types of Examination Board: the Final Year 'Honours' Board and the General Board.

The Final Year (or 'Honours') Board of Examiners meets in June to review the performance of all final year students. A decision is made at the Board on the class of degree to be awarded to each student. Subsequent to the meeting of the Final Year Board results are made available to individual students via PEGASUS.

The MEng may be awarded 'with Distinction' or 'with Merit'.

Students can graduate from the BEng degree with one of five classifications of degrees:

- First Class Honours
- Second Class Honours (Upper Division)
- Second Class Honours (Lower Division)
- Third Class Honours
- Pass

The General Board of Examiners considers the performance of all students other than those in the final year. The General Board meets first in late June, and analyses students' performance in all degree examinations (whether taken in the First or Second Semester). The Board makes one of the following decisions:

A Clear **Pass** The student has no re-sits and should proceed to the next year of study.

May Proceed The student may proceed to the next year of the course, but should take re-sits in those classes which (s)he has failed.

Withdraw The student will be instructed to withdraw from the course.

Re-sit (June Board only). The student should take re-sit examinations in August, after which a decision will be made on possible progress to the next year of study.

Do Not Proceed (September Board only). The student has not satisfied the requirements for progress to the next year of his/her course and will be required to enter academic suspension. (S)he may take re-sit examinations in the coming Session.

Re-attend The student has not satisfied the requirements for progress to the next year of his/her course. (S)he is required to re-attend the current year (for which the standard tuition fee will be charged) before a further decision will be made by the Board regarding progress.

Overseas Semester(s) (June Board only): the student has taken part in an overseas exchange and some or all of his/her marks are not yet available.

Unusual circumstances dictate that the student should receive a Special Letter, outlining his/her academic position as determined by the Examiners.

Transfer - The student will be transferred to another course. This can be qualified by a decision of:

Transfer + Suspend or Transfer and Resit.

An MEng or BEng Honours student may be transferred from an MEng to BEng Hons stream or from a BEng Hons to BEng Pass stream if the student is not performing at a high enough level.

In addition to making one of the decisions above, the Board may decide:

Either

i to **caution** a student whose performance has been poor. In this case, the Faculty Manager or other attending administrator will inform the student that this poor performance gives cause for concern, and advise him/her to consult his/her Personal Development Adviser.

or

ii to **warn** a student that (s)he has almost exhausted their attempts at a class and that (s)he will have just one further opportunity to obtain a pass.

Examinations and Resit Attempts

If a student does not pass a particular examination then it is essential to resit outstanding examinations at the next examination diet or at the next available opportunity (or complete supplementary work to a satisfactory standard) so that eventually the total credits required for the final degree can be accumulated.

Note that although Examination Boards normally allow undergraduates two attempts to gain a particular credit (or submit supplementary work), such attempts must be at two consecutive offerings of the examination. It should also be noted that the marks used to determine the final honours or MEng grading are based on those obtained at the **first examination attempt**.

Use of Electronic Devices

Electronic devices are not permitted during examinations (unless with prior written permission of the Department/School). Electronic devices include, but are not limited to: mobile phones, music players, tablets and smart watches. Candidates are not permitted to bring earphones into the examination room. Candidates may make use of calculators in an examination room. Candidates

are not permitted to share the use of calculators except where they have been provided by examiners. At the discretion of the Head of Department/School, invigilators should normally try to ensure that calculators' memories are cleared at the beginning of each examination.

Examinations Outwith the University

It is a University Regulation that "All examinations shall take place at the University, or in the case of a class taught elsewhere, at the appropriate learning centre. In exceptional circumstances and at the request of the Head of Department responsible for the candidate's course of study, the Director of Corporate Services may authorise arrangements for examinations to be held elsewhere, subject to the payment by the candidate of any necessary costs."

Please also see the entry in Section 1 regarding this issue.

Faculty Compensation Scheme

The Faculty operates a Compensation Scheme which is designed to assist Boards of Examiners to take decisions about student progress at the end of each of the first, second and third years of undergraduate study and the first four years of an integrated Masters degree. Fail marks in the range 30-39% may be eligible for compensation under the scheme and converted to a pass provided the weighted credit average across the students prescribed curriculum is 45% or higher. Up to 20 credits may be compensated in this way. The scheme can be applied only to the student's first attempts and, therefore, is normally used only at the June meetings of the Boards of Examiners when the results from the January and May/June degree examinations are considered. Marks of N + a mark (i.e. where there is an exam result but missing coursework) are not eligible for compensation.

Faculty Office

The Faculty Office for Engineering is located on Level 5 of the Royal College. The Faculty Manager can be consulted for advice on submitting letters of appeal.

For Faculty staff, please see page26 or see contact details at http://www.strath.ac.uk/engineering/.

Faculty Policy of Teaching and Learning

The Faculty of Engineering adheres to all the University policies, procedures and guidelines on undergraduate and postgraduate teaching and learning that can be found via the link provided at the start of this General Information section.

In addition the Faculty has an excellent reputation for innovation in teaching and learning and examples of this can be found in all Departments. In 2004 the Faculty had extensive consultations with students drawn from the majority of Departments and this has resulted in the following Faculty policies being endorsed by the Board of Study for implementation in academic year 2006-07 onwards.

1. Departments should ensure coursework is returned to students within the semester and ideally within 2 weeks from the submission date

2. Worked examples to past examination papers should be provided

3. Learn Online should continue to be developed and staff should be encouraged to undertake training and move to wider usage.

4. Industrial lectures should be quality checked and only included where the material is clearly related to course content.

5. Industrial visits should be focused on application, clearly structured with explicit expectations and outcomes, and subject to evaluation.

Fee Payments and Grants

UK students applying for support from the Student Awards Agency for Scotland (SAAS) or a Local Education Authority (LEA) are expected to submit applications to the relevant award agency at the earliest opportunity.

Students from the European Union registered for an undergraduate degree course can also apply to the SAAS for fee support, but are not able to apply for UK student loans.

Graduation

Award Ceremonies (or Congregations) are held in June/July and October/November each year. All students hoping to graduate or be presented must enroll to graduate by completing a form and paying the appropriate fee. Details of the ceremonies and enrolment forms are usually available from Student Experience in March each year.

Student Experience

Student Experience is based on Level 1 of the McCance Building. All changes to classes/courses **must** be notified to Student Experience **by your department** (please contact your Year Adviser). Student Experience hours of opening are:

Monday-Friday: 1000 to 1600 hours

Out-with these times, information and forms are available on a stand outside Student Experience and much of the information/forms you may require are available on the Student Experience website at:

http://www.strath.ac.uk/sees/ or http://www.strath.ac.uk/studentlifecycle/

Sponsorship

Student sponsorship is reasonably common within the Departments in the Engineering Faculty - http://www.strath.ac.uk/engineering/scholarships/. The advantage of sponsorship is that a company will usually supplement a student's income and offer employment in the summer vacation; there may also be the possibility of graduate employment on completion of his/her studies. Students in 1st, 2nd or 3rd year may find it worthwhile to spend some time identifying companies willing to offer sponsorship. Look out for companies advertising that they operate a sponsorship scheme – check the notices in the Departments, the Careers Library or newspapers. If you are unsure whether a particular company operates a sponsorship scheme, write to their Human Resources Manager, requesting information.

Student Complaints

Please refer to the website for the complaints procedure.

http://www.strath.ac.uk/staff/policies/academic

Overseas Study

Please also refer to 'Study Abroad' in Section 1 of this handbook.

Erasmus

Strathclyde is a leading participant in the ERASMUS programme. Under this programme the student can apply to spend a minimum of 3 months or up to a maximum of a full academic year of his/her course as an exchange student at a partner university in Europe. Approximately 50 Strathclyde students participate in Erasmus exchange each year, mostly during their third year.

If students are interested in this opportunity they should contact their department to find out if it participates in the programme and what options are open to them.

International Student Exchange Programme

Strathclyde students have the opportunity to spend a year of their degree as exchange students at universities in the USA, Canada, Australia and Singapore. This can be as part of an individual exchange agreement between Strathclyde and an overseas University.

Please contact Allison Handley in the Recruitment & International Office for further details.

5th Year Exchange

The department offers opportunities for MEng students to study abroad in 5th year. This usually involves taking the 5th year Group Project Abroad as groups of Strathclyde students in first semester. This opportunity currently includes Japan, China, Brazil and a range of institutions in Europe. Details will be publicized during semester 1 of your 4th year.

Section 3

Educational Aims & Course Regulations

The educational aims communicated to students via course literature indicate that the course is designed to graduate qualified professional engineers and that a student will:

Develop the capacity to learn independently and to master new ideas and technologies.

Increase skills in communicating and working effectively with others – individually and in teams.

Develop a sound working knowledge of the fundamentals of systems and processes, which are generally recognised to be in the domain of mechanical engineering and related subjects.

Develop the ability to understand, model and predict the behaviour of engineering artefacts through the application of mathematical, scientific and technological principles.

Be provided with extensive practice in creating new engineering solutions, adapting old ones, and in using acquired knowledge in materials, energy systems, manufacture and computer-aided design techniques.

Practice formulating, monitoring and adjusting project plans in the light of changing circumstances.

Develop an understanding of financial, organisational and strategic aspects of engineering businesses.

Have as many opportunities as practicable to follow special interests and activities during the programme.

Have the opportunity to develop foreign language capabilities.

Grow to understand his/her place as a professional engineer within engineering and the wider community.

Meet the Educational Base requirements for eventual registration as a Chartered Engineer.

11.47 Department of Mechanical & Aerospace Engineering

Mechanical Engineering

BEng with Honours in Aero-Mechanical Engineering
BEng with Honours in Mechanical Engineering
BEng with Honours in Mechanical Engineering with International Study
BEng in Mechanical Engineering
Diploma of Higher Education in Mechanical Engineering
Certificate of Higher Education in Mechanical Engineering

Course Regulations [These regulations are to be read in conjunction with Regulation 11.1]

Status of the Courses

11.47.1 All students are normally admitted in the first instance as potential Honours students. Transfer between these courses is possible prior to the third year of study. Transfer to the MEng degree courses in Mechanical Engineering, Mechanical Engineering with International Study and Aero-Mechanical Engineering is possible prior to the fourth year of study subject to satisfying the appropriate progress requirements.

Mode of Study

11.47.2 The courses are available by full-time study only.

Place of Study

11.47.3 The BEng course in Mechanical Engineering with International Study requires study at an approved institution abroad. Such study will normally extend over a minimum period of 30 weeks.

Curriculum
First Year

11.47.4 All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
16 132	Engineering Mechanics 1	1	20
EE 108	Electrical Circuits	1	10
ME 101	Heat and Flow 1	1	10
ME 105	Mechanical Engineering Design	1	20
ME 107	Experimental and Laboratory Skills	1	10
ME 108	Engineering Analysis and Numerical Methods	1	10
MM 117	Mathematics 1M	1	20
Elective Class(es)			20

Second Year

11.47.5 All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
16 232	Engineering Mechanics 2	2	20
16 288	Professional Studies	2	10
19 222	Electrical Machines and Control	2	10
ME 203	Heat and Flow 2	2	20
ME 209	Mathematical Modelling and Analysis	2	20
ME 212	Materials Engineering and Design	2	10
ME 214	Mechanical Engineering Design 2	2	10

together with classes appropriate to the chosen course:

Aero-Mechanical Engineering

16 231	Flight and Spaceflight 1	2	10
ME 201	Aero Design and Flight Test	2	10

Mechanical Engineering
Mechanical Engineering with International Study

Elective Class(es)		20

Students wishing to obtain credits for participation on a Vertically Integrated Project (VIP) shall replace ME 214 Mechanical Engineering Design 2 with:

VP 201	Vertically Integrated Project 201	2	10
or			
VP 202	Vertically Integrated Project 202	2	10

Third Year

11.47.6 All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
16 327	Structural Mechanics	3	10
16 361	Dynamics and Control	3	20
16 363	Engineering Analysis 3	3	20
ME 301	Heat and Flow 3	3	20
ME 415	Strategic Analysis of Engineering Business Case Studies	4	10
ME 416	Engineering Ethics	4	10

together with classes appropriate to the chosen course:

Aero-Mechanical Engineering

16 351	Flight and Spaceflight 2	3	10
16 309	Aero-Design 2	3	20

Mechanical Engineering
Mechanical Engineering with International Study

ME 312	Mechanical Design 3A	3	10
ME 313	Mechanical Design 3B	3	20

Mechanical Engineering with International Study

All students are normally required to undertake study abroad at an approved institution and shall follow an approved curriculum reflecting that undertaken by students taking the Mechanical Engineering course. Such study will normally extend over a minimum period of 30 weeks.

Students wishing to obtain credits for participation on a Vertically Integrated Project (VIP) shall replace ME 415 Strategic Analysis of Engineering Business Case Studies with:

VP 301	Vertically Integrated Project 301	3	10
or			
VP 302	Vertically Integrated Project 302	3	10

Fourth Year

11.47.7 All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		**Level**	**Credits**
16 402	Case Studies in Engineering	4	10
16 429	Computer Aided Engineering Design	4	20
ME 403	Engineering Materials Selection	4	10
ME 405	Heat and Flow 4	4	10
ME 414	Advanced Mechanics and Dynamics	4	20

together with classes appropriate to the chosen course:

Aero-Mechanical Engineering

ME 410	Aerodynamic Performance	4	10
ME 420	Individual Project - Aerospace	4	40

ME420 Individual Project - Aerospace can be used to contribute towards a Vertically Integrated Project (VIP).

Mechanical Engineering
Mechanical Engineering with International Study

ME 404	Energy Systems Modelling	4	10
ME 409	Individual Project	4	40

ME409 Individual Project can be used to contribute towards a Vertically Integrated Project (VIP).

Progress

11.47.8 Progress to a period of study abroad is dependent on passing all compulsory classes. A student registered for the Mechanical Engineering with International Study course who does not meet this requirement at this stage will be required to transfer to another course.

11.47.9 In order to progress to the second year of the course, a student must have accumulated at least 100 credits from the course curriculum.

11.47.10 In order to progress to the third year of the course, a student must have accumulated at least 220 credits from the course curriculum.

11.47.11 In order to progress to the fourth year of the chosen course, a student must have accumulated at least 360 credits from the course curriculum.

11.47.12 **Final Assessment and Honours Classification**
The final Honours classification will normally be based on the first assessed attempt at compulsory and specified optional classes taken in the second, third and fourth years.

Award

11.47.13 **BEng with Honours:** In order to qualify for the award of the degree of BEng with Honours in the chosen course, a candidate must have accumulated no fewer than 480 credits from the course curriculum

11.47.14 In order to qualify for the award of BEng with Honours in Mechanical Engineering with International Study, in addition to satisfying the provisions of Regulation 11.47.13, a student must normally have spent no fewer than 30 weeks of approved study abroad.

11.47.15 **BEng:** In order to qualify for the award of the degree of BEng in Mechanical Engineering, a candidate must have accumulated no fewer than 360 credits from the course curriculum.

11.47.16 **Diploma of Higher Education:** In order to qualify for the award of a Diploma of Higher Education in Mechanical Engineering a candidate must have accumulated no fewer than 240 credits from the course curriculum.

11.47.17 **Certificate of Higher Education:** In order to qualify for the award of a Certificate of Higher Education in Mechanical Engineering, a candidate must have accumulated no fewer than 120 credits from the course curriculum.

Transfer

11.47.18 A candidate who fails to satisfy the progress or award requirements for the BEng in Mechanical Engineering or BEng in Aero-Mechanical Engineering may be transferred to the degree of BEng in Engineering Studies.

12.47 Department of Mechanical Engineering

Mechanical Engineering

MEng in Aero-Mechanical Engineering
MEng in Mechanical Engineering
MEng in Mechanical Engineering with Aeronautics
MEng in Mechanical Engineering with Financial Management
MEng in Mechanical Engineering with Materials Engineering
MEng in Mechanical Engineering with International Study

Course Regulations [These regulations are to be read in conjunction with Regulation 12.1]

Status of the Courses

12.47.1 The courses are at Integrated Masters level. Transfer to the BEng degree in Mechanical Engineering or to the BEng with Honours degrees in Aero-Mechanical Engineering, Mechanical Engineering or Mechanical Engineering with International Study is possible at any time subject to satisfying the appropriate progress requirements. Transfer between the MEng degrees may be possible at any time prior to the fourth year of study.

Mode of Study

12.47.2 The courses are available by full-time study only.

Place of Study

12.47.3 The MEng in Mechanical Engineering with International Study requires study at an approved institution abroad. Such study will normally extend over a minimum period of 30 weeks.

Curriculum
First Year

12.47.4 All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
16 132	Engineering Mechanics 1	1	20
ME108	Engineering Analysis and Numerical Methods	1	10
EE 108	Electrical Circuits	1	10
ME 101	Heat and Flow 1	1	10
ME 105	Mechanical Engineering Design	1	20
ME 107	Experimental and Laboratory Skills	1	10
MM 117	Mathematics 1M	1	20
Elective Class(es)			20

Second Year

12.47.5 All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
16 232	Engineering Mechanics 2	2	20
16 288	Professional Studies	2	10
19 222	Electrical Machines and Control	2	10
ME 203	Heat and Flow 2	2	20
ME 209	Mathematical Modelling and Analysis	2	20
ME 212	Materials Engineering and Design	2	10
ME 214	Mechanical Engineering Design 2	2	10

together with classes appropriate to the chosen course:

Mechanical Engineering
Mechanical Engineering with International Study
Mechanical Engineering with Materials Engineering

Elective Class(es)			20

Aero-Mechanical Engineering
Mechanical Engineering with Aeronautics

16 231	Flight and Spaceflight 1	2	10
ME 201	Aero Design and Flight Test	2	10

Mechanical Engineering with Financial Management

AG 151	Introduction to Finance and Accounting	1	20

Students wishing to obtain credits for participation on a Vertically Integrated Project (VIP) shall replace ME 214 Mechanical Engineering Design 2 with:

VP 201	Vertically Integrated Project 201	2	10
or			
VP 202	Vertically Integrated Project 202	2	10

Third Year

12.47.6 All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
16 327	Structural Mechanics	3	10
16 361	Dynamics and Control	3	20
16 363	Engineering Analysis 3	3	20
ME 301	Heat and Flow 3	3	20
ME 415	Strategic Analysis of Engineering Business Case Studies	4	10
ME 416	Engineering Ethics	4	10

together with classes appropriate to the chosen course:

Aero-Mechanical Engineering
Mechanical Engineering with Aeronautics

16 351	Flight and Spaceflight 2	3	10
16 309	Aero- Design 2	3	20

Mechanical Engineering
Mechanical Engineering with Financial Management
Mechanical Engineering with Materials Engineering
Mechanical Engineering with International Study

ME 312	Mechanical Design 3A	3	10
ME 313	Mechanical Design 3B	3	20

Mechanical Engineering with International Study
Students who elect to undertake study abroad in their third year must do so at an approved institution and shall follow an approved curriculum reflecting that undertaken by students taking the Mechanical Engineering course. Such study will normally extend over a minimum period of 30 weeks.

Students wishing to obtain credits for participation on a Vertically Integrated Project (VIP) shall replace ME415 Strategic Analysis of Engineering Business Case Studies with:

VP 301	Vertically Integrated Project 301	3	10
or			
VP 302	Vertically Integrated Project 302	3	10

Fourth Year

12.47.7 All students will undertake classes amounting to 120 credits as follows:

Compulsory Classes		**Level**	**Credits**
16 402	Case Studies in Engineering	4	10
16 429	Computer Aided Engineering Design	4	20
ME 403	Engineering Materials Selection	4	10
ME 405	Heat and Flow 4	4	10
ME 414	Advanced Mechanics and Dynamics	4	20

together with classes appropriate to the chosen course:

Aero-Mechanical Engineering
Mechanical Engineering with Aeronautics

ME 410	Aerodynamic Performance	4	10
ME 420	Individual Project - Aerospace	4	40

ME420 Individual Project - Aerospace can be used to contribute towards a Vertically Integrated Project.

Mechanical Engineering
Mechanical Engineering with Financial Management
Mechanical Engineering with Materials Engineering
Mechanical Engineering with International Study

ME 404	Energy Systems Modelling	4	10
ME 409	Individual Project	4	40

ME409 Individual Project can be used to contribute towards a Vertically Integrated Project.

Fifth Year

12.47.8 All students, with the exception of those who elect to spend fifth year of studies abroad, shall undertake 120 level 5 credits as follows:

Aero-Mechanical Engineering

Compulsory Classes

ME 525	MEng Group Project - Aerospace	5	40
16 599	Aerodynamic Propulsion Systems	5	10

together with optional classes chosen from Regulation 12.47.9

Mechanical Engineering
Mechanical Engineering with Aeronautics
Mechanical Engineering with International Study

Compulsory Classes

ME 519	Group Project	5	40

together with optional classes chosen from Regulation 12.47.9

Mechanical Engineering with Financial Management

Compulsory Class

ME 519	Group Project	5	40
ME 515	Finance for Mechanical Engineers	5	60

together with optional classes chosen from Regulation 12.47.9

Students who elect to undertake their period of study abroad in fifth year must do so at an institution acceptable to the Head of Department and shall be registered for ME524 – MEng Group Project Abroad.

Mechanical Engineering with Materials Engineering

ME 519	Group Project	5	40
16 565	Engineering Composites	5	10
ME 523	Polymer and Polymer Composites	5	10

together with optional classes chosen from Regulation 12.47.9

ME519 Group Project or ME525 MEng Group Project - Aerospace can be used to contribute towards a Vertically Integrated Project.

12.47.9 **Optional Classes**

16 565	Engineering Composites	5	10
16 587	Pressurised Systems	5	10
16 599	Aerodynamic Propulsion Systems	5	10
ME 505	Machine Dynamics	5	10
ME 507	Machinery Diagnosis and Condition Monitoring	5	10
ME 511	Mathematical Modelling in Engineering Science	5	10
ME 512	Spaceflight Mechanics	5	10
ME 514	Advanced Topics in Fluid Systems Engineering	5	10
ME 517	Spaceflight Systems	5	10
ME 520	Advanced Research Project A	5	10
ME 521	Advanced Research Project B	5	20
ME 523	Polymer and Polymer Composites	5	10
ME 526	Engineering Plasticity	5	10
ME 527	Introduction to Engineering Optimisation	5	10
ME 528	Control Systems Design	5	10

Exceptionally, such other level 5 classes totalling no more than 20 credits as approved by the Course Director.

12.47.10 **Class Combinations**

ME 515 Finance for Mechanical Engineers	60	Finance classes at an appropriate level as may be approved by the Adviser of Study

Progress

12.47.11 Progress to a period of study abroad is dependent on passing all compulsory classes. A student registered for the Mechanical Engineering with International Study course who does not meet this requirement at this stage will be required to transfer to another course.

12.47.12 In order to progress to the second year of the course, a student must have accumulated at least 100 credits from the course curriculum.

12.47.13 In order to progress to the third year of the course, a student must have accumulated at least 220 credits from the chosen course curriculum.

12.47.14 In order to progress to the fourth year of the course, a student must have accumulated at least 360 credits from the chosen course curriculum.

12.47.15 In order to progress to the fifth year of the course, a student must have accumulated at least 480 credits from the chosen course curriculum.

Final Assessment and Classification

12.47.16 The final classification for the degree of MEng in the chosen course will normally be based on the first assessed attempt at compulsory and specified optional classes in the second, third, fourth and fifth years.

Award

12.47.17 **MEng:** In order to qualify for the award of the degree of MEng in Aero-Mechanical Engineering or the MEng in Mechanical Engineering or the MEng in Mechanical Engineering with International Study, or the MEng in Mechanical Engineering in the chosen specialisation, a candidate must have accumulated no fewer than 600 credits from the appropriate course curriculum.
In addition, candidates for the degree of Mechanical Engineering with International Study must satisfy the requirements of 12.47.19.

12.47.19 A candidate for the award of MEng in Mechanical Engineering with International Study in addition must normally have undertaken no fewer than 30 weeks of approved study abroad.

Transfer

12.47.20 A candidate who fails to satisfy the progress or award requirements for the degree of MEng may be transferred to the degree of BEng in the chosen course where available.

Section 4

Class Details

Class Syllabuses

(R) = Registrar in charge of class.

NB: Past exams papers (hard and electronic copies) can be found in the University Library. Module Description Forms for all classes which follow can be found on the Departmental website at http://www.strath.ac.uk/mae/currentstudents/. These contain comprehensive (and sometimes more up-to-date) information on all classes – in particular, after the end of academic year 2015/16, you could find that several staff/registrars or specifics may have changed.

Module Assessments: please refer to each specific MDF on the above webpage.

First Year

Year Adviser: Prof J T Boyle (all class enquiries to be directed to Registrars (R))

16132 Engineering Mechanics 1 - 20 credits (ECTS 10)

Semester 1 and 2: Prof J T Boyle (R), Dr R Hamilton

Educational Aim:
A study of mechanics gives you the basic tools to understand how the world, both natural and man-made, works - if you take the time to do this carefully, then you will be well prepared for more advanced studies in mechanical engineering. A knowledge of mechanics is a fundamental tool for a mechanical engineer. Our purpose is to understand what has become known as classical mechanics. The concepts of classical mechanics you will deal with include a study of forces, motion, energy, work, momentum and heat, how these are connected, and how these ideas can be applied to engineering problems. The ideas behind classical mechanics changed the human race absolutely and forever. Most historians agree that no discovery in human thought has been more influential.

Students come to engineering mechanics with an elementary understanding of the basic principles of mechanics acquired from introductory school physics together with their application to problem solving. This class places more emphasis on the basic skills (see Specific Outcomes below) required to start to apply these concepts and principles to real engineering problem solving. The class focuses on the practice of these skills, rather than factual content. In this class doing required background reading, coming to class and doing homework are like practising for a football team (or musical group, using a simple analogy). The tutor/lecturer is less a source of information and more of a coach (or conductor) who structures practice and sets standards. Students' progress not by absorbing (and regurgitating) information but rather by practising their skills individually and learning to work effectively with others. The exams are like league games (or concerts) where students test their skills in a situation where performance counts.

Syllabus:
Statics; frameworks; friction; velocity and acceleration; inertia and change of motion; motion in a circle; balancing; periodic motion; dynamics of rotation; work, energy and power; impulse and momentum; aircraft mechanics.

ME101 Heat and Flow 1 - 10 credits (ECTS 5)

Semester 1 and 2: Dr W Dempster (R)

Educational Aim: Knowledge of Thermodynamics, Heat and Fluid Flow are important for the understanding and design of thermal and hydraulic systems involving energy conversion and transmission, such as engines and turbines, pumps and compressors, and associated pipework.

The aim of the class is to introduce the basic concepts of Thermodynamics and Fluid Mechanics, and the applications thereof, as a foundation for further studies.

Syllabus: An introduction to energy conversion processes and systems involving work and heat transfer. Conversion of energy from one form to another. The First Law of Thermodynamics. Non flow processes involving perfect gases. The properties of systems such as pressure, temperature and energy. The Continuity Equation, Bernoulli's Equation, Applications to flow in pipes, nozzles, siphons.

ME105 Mechanical Engineering Design - 20 credits (ECTS 10)

Semester 1 and 2: Dr A McLaren (R), Dr B Keating, Mr F Gaddis (DMEM)

Educational Aim: The aim of this class is to place the essential elements of design at the heart of courses for Mechanical Engineering students. It shows how the disparate elements of engineering science may be brought together and used to create a safe, durable and cost-effective solution to a perceived engineering need.

Syllabus: The module will teach the following:

a) Mechanical dissection of an engineering artefact is used to illustrate and understand the fundamental elements of the design process.

b) An introduction to formal design methods, sketching and drawing.

c) Integration of engineering science elements within a framework of design; build and test projects.

d) An introduction to PTC Creo software

ME107 Experimental and Laboratory Skills - 10 credits (ECTS 5)

Semester 1 and 2: Dr A McLaren (R), Dr P Munoz-Escalona

Educational Aim: The aim of the class is to introduce students to a range of experimental and laboratory related skills, appropriate to Mechanical and Aerospace Engineering. This will include elements of laboratory and workshop safety including risk assessment procedures. Students will gain familiarity with a range of hand tools and welding/joining procedures and develop an understanding of how to conduct experiments, record data, evaluate errors and write a technical report.

Syllabus: The module will teach the following:

a) Each student will attend two afternoons of hand/power tools training, and one afternoon of welding and joining. A short online individual reflective report will be submitted for each activity.

b) Each student group will complete a risk assessment as part of the Mechanical Dissection element of class ME105 Mechanical Engineering Design. Following this lab, each student will submit an individual online version of this risk assessment, including a personal reflection on lab safety.

c) Each student will attend two experimental sessions to conduct experiments related to core classes in the first year Mechanical Engineering curriculum. Each lab session will be preceded by an online pre-lab giving background information to each task. Students will submit a formal lab report which will be formatted in a standard style to introduce report writing skills including error analysis and referencing.

d) Each student will participate individually and as student group in online discussion forums.

ME108 Engineering Analysis and Numerical Methods – 10 credits (ECTS 5)

Semester 1 and 2: Dr H Chen (R), Dr Z Wu, Prof D Mackenzie

Educational Aim**:** This module aims to teach the basic principles of programming and the solution of mathematical problems with numerical techniques.

Syllabus: The module will teach the following:

1. Introduction to Matlab; Matlab as a calculator; Matlab as a programming language.
2. Programming principles: variables and arrays; operators, expressions and statements; algorithms, programming logic and flow diagrams; computer arithmetic and errors.
3. Fundamentals of programming in Matlab: data types; input and output; functions and structures; parameters and variables; memory allocation.
4. Mathematical methods: linear algebra, vectors & matrices.
5. Numerical Methods: solution of simultaneous linear and nonlinear equations; differentiation and integration; numerical quadrature; interpolation and curve fitting.

EE108 Electrical Circuits - 10 credits (ECTS 5)

Semester 1 and 2: Dr P Niewczas (R), Dr R O'Leary

Educational Aim:
Mechanical systems rely upon electrical and electronic circuits for many reasons: delivery of drive power; sensing temperature, pressure, etc.; the delivery of sensor data to operators for condition monitoring; control and operation of systems. For example, instrumentation systems for aircraft, ships, cars and many other applications electronically manipulate, process and display data from external sensors and devices. This course covers the important issue of how external data is acquired, conditioned and used within mechanical engineering systems. It also discusses how electronics are used to control mechanical systems. It will equip students with an understanding of the basic theories underlying electronics. Based on these, data acquisition technology will be discussed from analogue transducers through signal filtering, amplification and conditioning for use within digital circuits. It will detail the importance of this area within engineering systems through specific case study examples, which include monitoring aircraft, monitoring industrial processes, telecommunications, medical applications, etc.

Syllabus: The module will teach the following:

• Basic electrical theory and definitions: electrons; charge; current; voltage; power; sources.
• Basic DC circuits: resistance; calculation of total resistance, current and voltage
• Kirchhoff's Law, Thevenin and Norton equivalent circuits.
• Basic models of amplifiers and operational amplifiers
• Basic digital electronics: boolean logic; logic gates; counters.
• Basic AC circuits: concept of phase; frequency; capacitors; inductors; impedance; use of j operator.
• Definition of data acquisition systems and applications
• Case studies of complete engineering systems, covering:
• Analogue to digital conversion
• Digital to analogue conversion
• Interfaces
• Control systems
• Other applications in engineering, medicine, aerospace, etc.

MM117 Mathematics 1M - 20 credits (ECTS 10)

Semester 1 and 2: Dr E Dombi (R)

Educational Aim: To give a basic understanding of the concepts and applications of mathematical functions, complex numbers, vectors, matrices, differentiation and integration.

Syllabus:

Algebra and Geometry

- Basic algebra: mathematical notation and operations; manipulating formulae and solving equations (linear, quadratic, polynomial; simultaneous equations in 2 unknowns); set and interval notation; the binomial expansion.
- Functions: basic concepts (graph, domain and range); continuity and limits; composition of functions; one-to-one functions and inverses; linear, quadratic and polynomial functions; exponentials and logarithms; rational functions; the modulus function; odd and even functions.
- Trigonometry: sin, cos and tan; radian measure; graphs, periodicity; sec, cosec and cot; trigonometric identities; the wave function; trigonometric equations.
- Vectors: magnitude and direction; vectors as directed line segments; vector algebra; orthogonal unit vectors; representation of vectors as number triples; scalar and vector products.
- Complex numbers: motivation and definition; roots of quadratic equations; real and imaginary parts; the arithmetic and algebra of complex numbers. The Argand diagram; modulus and argument; polar form (trigonometric and exponential); products and quotients in polar form; hyperbolic functions; De Moivre's theorem and its consequences.
- Matrices: definition, terminology and properties; scalar multiplication and addition of matrices; matrix multiplication (pre- and post-multiplication; non-commutativity; associativity). Systems of linear equations - matrix representation; the inverse of a square matrix; singular and non-singular matrices; solution of a system of linear equations using the inverse matrix; elementary row operations; Gaussian elimination.

Calculus

- Motivation and definitions: velocity (average and instantaneous); definition of a derivative; simple examples from first principles; notations (dy/dx, f'(x), d(f(x))/dx); graphical interpretation in terms of tangent to a graph; stationary points; higher derivatives.
- Standard derivatives: derivatives of x^a, sin (x), cos(x); the exponential and natural log functions and their derivatives; the inverse trigonometric functions sin^{-1}(x) and tan^{-1}(x) and their derivatives.
- Rules of differentiation: linearity; the chain rule; the product rule; the quotient rule.
- Implicit differentiation: first derivatives; simple cases of second derivatives.
- Parametric differentiation: first derivatives; simple cases of second derivatives; related rates of change.
- Applications: graph sketching; optimisation problems; linear approximation and error analysis.
- Indefinite integration: antiderivatives; standard integrals.
- Definite integration: the area under a curve; definition as a limit of a Riemann sum; the Fundamental Theorem of Calculus; infinite limits.
- Methods of integration: linearity; substitution; integration by parts; integration of simple rational functions; integrals of some trigonometric functions.
- Applications: area between two curves; volumes of revolution; arc length of a plane curve.

Second Year

Year Adviser: Dr B Keating (all class enquiries to be directed to Registrars (R))

16231 Flight and Spaceflight - 10 credits (ECTS 5)

Semester 1 and 2: Dr M Stickland (R), Prof R Brown

Educational Aim: This module aims to give a theoretical and historical background to the development of modern aircraft and spacecraft design.

Syllabus: The module will teach the following:

1. History of flight.
2. Theoretical aerodynamics: aircraft layout and nomenclature, lift and drag coefficients, Bernoulli's equation.
3. Generation of lift: aerofoil aerodynamics, boundary layers, stall, high lift devices.
4. Generation of drag: lift induced, wave, form, skin friction, interference, trim, cooling.
5. Flight instruments: airspeed indicator, indicated and equivalent airspeed, altimeter, rate of climb meter, International Standard Atmosphere.
6. Bluff body aerodynamics: flows past cylinders, spheres and bluff bodies, vortex shedding industrial aerodynamics.
7. Generation of thrust: propeller theory, history of turbojet development, gas turbines, inlets, compressors, combustion chambers, turbines and afterburners.
8. Spaceflight: history of rocket development, rocket engines, multistaging, escape velocity.

16232 Engineering Mechanics 2 - 20 credits (ECTS 10)

Semester 1 and 2: Dr R Hamilton (R), Dr L Yang

Educational Aim:

Semester 1

To develop skills, knowledge and understanding in the areas of structural analysis and elementary stress analysis. The work is divided into 4 parts i) statics revision including shear force and bending moment diagrams ii) beams in bending iii) shear and torsion iv) 2D stress and strain.

Semester 2

The module aims to provide students with the basic skills to analyse dynamics problems, associated with bodies and simple mechanisms, from first principles.

Syllabus:

Semester 1

Tensile test – uniaxial systems, temperature and pre-load effects. Engineers' theory of bending. Direct and bending effects. Shear stress due to torsion and bending. Two dimensional stress and strain including Mohrs circle for stress and Von Mises and Tresca yield criterion.

Semester 2

Rectilinear and angular motion where acceleration is a function of time, displacement and velocity. Centre of mass and moment of inertia of a composite object. Dynamic equivalence and connected systems. Free vibration analysis of an undamped single degree of freedom system – Simple Harmonic Motion.

16288 Professional Studies - 10 credits (ECTS 5)

Semester 2: Prof R Brown (R)

The aim of this class is to create awareness of and develop some of the skills expected in graduate professional engineers. These include development of communication skills (both oral and written), but also issues such as ethics, societal impact and future trends.

Syllabus: The module will teach the following:

- Communication skills: written and oral.
- Group working skills.
- Professional conduct, ethics and the legal aspects of professional responsibility.
- Self-presentation, the standard application form and the CV.
- Introduction to psychometric testing criteria and interpretation.
- Engineering ethics.
- Societal and contemporary issues.

ME201 Aero-Design and Flight Test - 10 credits (ECTS 5)

Semester 2: Dr M Macdonald (R), Prof R Brown, Dr M Stickland

Educational Aim: This module builds on the initial work carried out in Flight and Space Flight 1. The taught part of the class is reinforced by experimental investigation, flight experience and flight test. The class is also intended to introduce students to the mathematical modelling tools they will require in the third year aero design class.

Topics covered include:

- Aircraft design.
- Airworthiness and the flight envelope.
- Static, longitudinal stability and control of aircraft is considered.
- The standard atmosphere – variation of temperature, pressure and density with height is explained.

The calculation of the performance of aircraft is studied: Indicated and true airspeed. Steady level flight – minimum drag and minimum power flight speed. Steady glide and climb. Take-off and landing. Steady turning flight. Range and endurance. Flight and gust envelopes.

Students may opt out of the flight training course should they wish, however this is not recommended.

Syllabus: The module will teach the following:

- Aircraft design process
- Airworthiness
- Longitudinal stability and control.
- Flight performance.
- Flight test course

ME203 (*ME204, ME205) Heat and Flow 2 - 20 credits (ECTS 10)

Semester 1 and 2: Dr M Oliveira (R), Dr Y Zhang, Dr I Taylor

*NB: Alternative codes for incoming exchange students only: ME205 sem1; ME204 sem2 (10credits)

Educational Aim: This module aims to deliver fundamental knowledge on fluid mechanics and thermodynamics and illustrate their importance to engineering systems. Thermodynamics is the science that is devoted to understanding energy in all its forms and how energy changes form. The aim of the first semester of this class is to supply the necessary analytical tools to study these energy changes when applied in engineering situations, in particular for transportation and power production. Fluid mechanics and the behaviour of fluids is an important aspect in the performance of engineering systems. In the second semester the underlying physics of fluid flow and its application to simple systems is presented.

Syllabus: The module will teach the following:

Semester 1: Thermodynamics
a) 1st law of thermodynamics applied to non-flow and steady flow systems
b) the properties of perfect gases
c) the properties of liquids and vapours
d) the 2nd law of thermodynamics, its implications and thermal efficiency
e) entropy and the concepts of the principle of increasing entropy, isentropic efficiency
g) assessment of the performance of vapour and gas power cycles

Semester 2: Fluid Mechanics

a) the influence of fluid properties on the behaviour of engineering systems
b) the concepts of conservation of mass, energy and momentum
c) dimensional analysis of an engineering process
d) significance of dimensionless parameters such as Reynolds and Mach numbers, and dimensional analysis.
e) design of simple pipe systems

ME209 Mathematical Modelling and Analysis - 20 credits (ECTS 10)

Semester 1 and 2: Dr H Chen (R), Dr P Davidson, Dr E Minisci, Dr Z Wu

Educational Aim:
Mathematics (Semester 1)
To give students competence in the differential and integral calculus of functions of several independent variables, and in the solution of ordinary differential equations (with particular emphasis on the Laplace transform method).

Engineering Analysis (Semester 1 and 2)
This class develops the general approach to the solution of engineering problems and involves mathematical modelling, numerical methods and the application of computer software. A wide range of engineering topics is presented and includes problems in structures, dynamics, fluids and heat transfer to emphasise the general applicability of the solution processes. The integration of mathematical techniques and the use of the computer as an essential tool in the modelling, simulation and solution of problems in engineering is an important objective of the class. It is also designed to demonstrate the power of mathematical methods to the formulation and manipulation of equations to represent complex engineering systems.

The first 6 weeks of both semester 1 and semester 2 present the fundamentals of numerical methods and formulation techniques in an engineering context and is taught in a lecture/tutorial format. In the last 6 weeks of each semester the emphasis changes to the application of the techniques previously developed to a range of engineering problems using the MATHCAD software. This part is taught in a computer based learning environment.

Syllabus:
ME209 Mathematical Modelling and Analysis is a combined module which consists of two separate modules Mathematics (MM217) and Engineering Analysis 2. The module will teach the following:

Mathematics (Semester 1)
Ordinary Differential Equations: first-order separable, linear; second-order linear; constant coefficients with forcing functions exp(kx), sin(kx), cos(kx) and polynomials, including sums of these.

Partial Differentiation: first and second derivatives, total differential, small errors, differentiation in a given direction, chain rule, implicit functions, stationary points; indicate extension to functions of more than two variables.

Double Integration: interpretation as a volume, evaluation as an iterated integral, change of order, change of variable from Cartesian to polars, application to centre of mass, moments of inertia.

Laplace Transform: definition, standard results, application to ODEs.

Engineering Analysis (Semester 1 and 2)

Concepts of mathematical modelling: case studies in formulation of equation systems and differential systems for structural, dynamic, fluid and thermal problems.

Mathematical methods: Linear algebra, matrices in engineering mechanics, linear operators, definitions; square matrices; inversion, and determinants and singularity; Gaussian elimination, LU decomposition.

Numerical methods: Solution of simultaneous linear and nonlinear equations; Jacobi and Gauss Seidel Iteration method; Newton Raphson method; Numerical differentiation and integration, applications to multiple integrals, numerical quadrature, evaluation of areas, interpolation and curve fitting.

Solution of ordinary differential equations: classification of solution methods with engineering applications in dynamics, thermodynamics, fluid mechanics, solid and structural mechanics using computer-aided engineering techniques. Numerical solution of ordinary differential equations, initial value problems, predictor corrector methods. Runge Kutta methods.

Software applications: Use of Mathcad and MATLAB.

ME212 Materials Engineering and Design - 10 credits (ECTS 5)

Semester 1: Dr A McLaren (R), Dr P Muñoz-Escalona

Educational Aim: The class aims to provide a grounding in concepts of material science and engineering with reference to mechanical design and material selection.

Syllabus: The module will teach the following:

Atomic bonding and crystal structure of solids. Strength and stiffness of common engineering materials. Materials for compression and tension structures. Engineering metals and alloys. Strengthening mechanisms and heat treatment. Elastic material properties. Ductile and brittle failure mechanisms of solids. Plasticity and creep. Stress concentration, fracture toughness and brittle fracture. Linear Elastic Fracture Mechanics (LEFM). Fatigue failure.

ME214 Mechanical Engineering Design 2 – 10 credits (ECTS 5)

Semester 1: Dr T Comlekci (R), Prof J Thomason

Educational Aim: This module aims to:

Develop competency in mechanism design using the PTC Creo software suite, building on the part creation, assembly and drawing creation competencies developed in ME 105.

Develop competency in materials selection for engineering design, using the CES Selector software.

Syllabus: This module aims to:

Develop competency in mechanism design using the PTC Creo software suite, building on the part creation, assembly and drawing creation competencies developed in ME 105.

Develop competency in materials selection for engineering design, using the CES Selector software.

19222 Electrical Machines and Control - 10 credits (ECTS 5)

Semester 2: Dr A Roscoe (R), Dr L Xu

General Aims: Engineering students from non-electrical disciplines often require a working knowledge and appreciation of electrical power devices and their use. This class develops the theory underlying simple electrical circuit analysis, transformers and electrical motors, and seeks to develop an understanding of their application through example and laboratory work.

Syllabus: The module will teach the following:

Practical and safety-related electrical knowledge: single-phase and 3-phase wiring colours; circuit breaker types and minimum breaking current.

Revision of DC and AC circuits: power in AC circuits; power factor and its correction;

Three phase systems: basic connections, definitions, justification, analysis of circuits with balanced loads,

Electromagnetism: concepts of magnetic fields; field quantities; material properties; permeability; B-H loop; hysteresis; eddy currents; inductance; force on a conductor and Faraday's Law/Lenz's Law; basic energy conversion.

Single Phase transformer: construction, operation and use; the ideal transformer; circuit model and performance analysis; tests and parameter evaluation; efficiency and regulation.

DC machines: introduction to electric motor action; basic DC motor design and construction, operation, use, and control using switched-resistor and tap-changing transformer/rectifier techniques; performance analysis using equivalent circuit models.

Induction machines: introduction to AC machines and rotating magnetic fields; induction machine construction, operation, use, equivalent circuit models and performance analysis.

Synchronous machines: introduction to synchronous machines; basic circuit model; performance analysis; relationship between inertia and rate-of-change of frequency (ROCOF) during transients.

Modern power electronics and control techniques: an appreciation of variable-speed drives - controlled rectifiers and forced-commutation power electronics; an appreciation of regenerative drives for traction applications and efficiency; an appreciation of other types of electrical machines and future applications.

AG151 Introduction to Finance and Accounting – 20 credits

Semester 1 and 2: Prof A Marshall (R), Dr D Andriosopoulos

Educational Aim:
This class aims to provide an understanding of the basic principles of finance and investment, both in theory and in practice. It also provides sufficient coverage of accounting principles to enable an understanding of the purpose and preparation company accounts, their usefulness for decision making and for the evaluation of business performance. The class provides a solid foundation for further studies in Finance. It begins with the concept of a business organisation and the role of the financial manager. It then covers in detail the fundamental concept of the time value of money followed by the valuation of securities such as bonds and shares, the appraisal of business investments. The class then introduces accounting by examining how financial statements are prepared, and the nature of the information they provide for investors and other users of accounts, as well as the behaviour of costs and the use of accounting within organisations. This aspect of the class also embraces corporate governance and the role of directors and auditors. This is followed by a detailed analysis of the risk of investing in financial securities such as company shares, and how this is linked with expected returns. Finally, the class covers important aspects of personal finance in everyday life.

Syllabus: The module will teach the following:

- The main elements of modern financial theory;
- The objectives of business organisations and the role of the financial manager;
- The application of the concept of the time value of money when valuing assets and investments;
- The correct procedures to value securities such as bonds and shares, and understand and measure the relationships between rates of return and security prices;
- How financial markets work, how securities are traded, and the role of financial institutions;
- The methods for evaluating business investment with an awareness of the strengths and weaknesses of various appraisal methods;
- The role and purpose of accounting in business organisations,
- How income statements, cash flow statements, and statements of financial position are prepared and interpreted; and their relevance and usefulness to business and other users of accounts;

- How to analyse business performance through the calculation and interpretation of financial ratios;
- How to explain directors' responsibilities and the role of the auditors in corporate governance;
- The nature of different types of risk when investing in securities, how risk is measured and managed, and the risk-return relationship;
- How the main principles of finance and investment apply to the decisions of an individual or family unit;

Third Year

Year Adviser: Mr C Johnstone (all class enquiries to be directed to Registrars (R))

16309 Aero-Design 2 - 20 credits (ECTS 10)

Semester 2: Dr M Stickland (R), Dr T Comlekci

Educational Aim: It is essential that students should have experience in applying engineering principles in a design context. It is the aim of this class to have students experience the application of knowledge, gained primarily from previous classes, to various stages of the design process together with new knowledge gained as part of project completion.

Syllabus: The class consists of a semester-long design/build/test group exercise.

The projects available each year will depend upon the staff involved in this class. A typical project which might be available is:

BMFA "University Challenge"
Groups of approximately 5 students design, build and test a small scale remote control aircraft to take part in the BMFA University Challenge. Over the 12 weeks of the semester, the groups will develop their design, build, test and optimise the design. The aircraft are taken by the teams to fly off in the competition held at Elvingon Airfield, York, in June. A small budget is allocated to each group. ***Please note: group participation is dependent on satisfactory peer mark in 16351.***

16327 Structural Mechanics - 10 credits (ECTS 5)

Semester 1: Dr M Wheel (R)

Educational Aim: This class is a direct continuation of the structures element of class 16232 and aims to extend the students' knowledge and understanding of the behaviour of materials and structures under a variety of loading conditions.

Syllabus: The module will teach the following:

Solid Mechanics: Two-dimensional stress and strain; multiaxial elastic constitutive relations; multiaxial yield criteria; general equations of elasticity leading to solutions for thick and thin cylindrical structures.

Structural Mechanics: Equations and analysis of continuous beams, both determinate and indeterminate; introduction to energy methods of analysis; superposition and dynamic loading effects; introduction to instability and buckling, including end-loaded columns with imperfections; design analysis of columns using British Standards or Euro-Codes.

16351 Flight and Spaceflight 2 - 10 credits (ECTS 5)

Semester 1: Dr M Stickland (R), Dr T Comlekci, Mr L Murphy (BAe Systems Warton)

Educational Aim: Flight and Spaceflight 2 builds on the initial work carried out in Flight and Spaceflight 1 and Aero Design 1 and is intended to develop the student's knowledge through the application of mathematical modelling of an aircraft's stability, control and performance in the design of a small scale UAV.

The equations of motion of an aircraft are developed as part of a two day short course on flight simulation given jointly by University staff and a simulation engineer from BAE SYSTEMS, Warton. This short course introduces the mathematics of flight simulation and the technology involved in flight simulator hardware and software. The course content is not examined but attendance is mandatory for the award of a credit for this class.

The design of a UAV for participation in the BMFA "University Challenge" is commenced.

Syllabus:

1. Longitudinal stability and control
2. Flight simulation
3. BMFA design project

16361 Dynamics & Control – 20 credits (ECTS 10)

Semester 1 and 2: Dr I Trendafilova (R), Prof M Vasile

Educational Aim
The Semester 1 Dynamics module aims to:

a) introduce the general principles of the kinematics of rigid bodies and different types of motion: translation, rotation and general plane motion;
b) study the kinetics of rigid bodies focussing on plane motion, equations of motion, angular momentum and D'Alembert's Principle;
c) utilise the fundamentals taught in second year Dynamics to demonstrate the principles of analysis of the dynamic performance of mechanical engineering systems;
d) Introduce the basics of modelling the vibrations of mechanical systems.
e) combine the fundamental theory of free and forced vibrations of damped and un-damped systems with some essential laboratory practice and demonstrations.

The Semester 2 Control element aims to:

a) introduce the concept of control theory to the students,
b) to provide essential knowledge to model a physical system and linearize it.
c) introduce the tools to design a feedback control system.
d) Develop skills to assess the performance of a feedback control system.

Syllabus
Semester 1 will teach the following:

- General kinematics and kinetics of rigid bodies: translation, rotation and general plane motion.
- Application of plane kinematics and kinetics to rigid bodies and mechanisms.
- Vibrations of a single degree of freedom (1dof) systems. Free and forced vibrations. Damping. Analysis of free and forced vibration of damped 1dof systems. Equivalent dynamic systems.

Semester 2 will teach the following:

- Control system types and system identification
- Dynamical systems representation: differential equations; linearisation; state space models
- Frequency domain representation; Laplace and inverse Laplace transformations
- Transfer function; State transition matrix
- Pole-zero analysis; introduction to system stability; Eigenvalues, eigenvectors;
- Routh theorem; root locus method
- Error analysis; steady-state error

16363 (*16366, 16367) Engineering Analysis III - 20 credits (ECTS 10)

Semester 1 and 2: Prof D Mackenzie (R), Dr B Keating, Dr E Minisci, Dr T Scanlon

*NB: Alternative codes for certain exchange students only: 16366 Sem 1, 16367 Sem 2 (10 credits)

Educational Aim: This module aims to introduce the students to the theory and application of the two most widely used numerical methods in engineering analysis: the Finite Element Method and Computational Fluid Dynamics.

Syllabus: The module will teach the following:

Semester 1: Mathematical modelling of engineering systems using the Finite Element Method: Theory and practice. Introduction to the commercial finite element program ANSYS Workbench; structural analysis; stress analysis.

Semester 2: Mathematical modelling of engineering systems using Computational Fluid Dynamics: Theory and Practice. Introduction of the commercial computational fluid dynamics program FLUENT; analysis of flow field; recirculation zones/stagnation points; boundary layers.

ME301 (*ME302, ME303) Heat and Flow 3 - 20 credits (ECTS 10)

Semester 1 and 2: Dr W Dempster (R), Dr T Scanlon

*NB: Alternative codes for certain exchange students only: ME302 Sem 1, ME303 Sem 2 (10 credits)

Educational Aim: The class builds on the students' previous study of thermodynamics and extends this to cover real gas behaviour,mixtures, psychrometry and its applications. It also extends the study of heat transfer. Here, heat transfer by conduction, convection and radiation is covered together with heat exchanger design.

In addition, this class takes the study of the laws of conservation of mass, energy and momentum applied to fluid flowto a more advanced level. The knowledge and understanding of fluid flow is extended and this class supplies the analytical tools to provide an appreciation of boundary layers and compressible fluid flow.

Syllabus:

Semester1: Fluid Mechanics

This class aims mainly to prepare students to tackle high speed flow systems.

The first part introduces students to one-dimensional compressible flows: sound/shock waves, flow structure in supersonic nozzles. Students also learn manipulating the one-dimensional mass continuity, momentum and energy equations.

The second part deals with subsonic/incompressible flows and introduces students to: boundary layers (both laminar and turbulent), aerodynamic forces, lift and drag, calculation from different flow structures.

Students are introduced also during this class to solving numerically some standard fluid dynamic problems in internal/external flows (Poiseuille, Couette, Shear-driven flow.)

Semester2: Thermodynamics

Heat transfer, one-dimensional conduction through plates, cylinders and spheres.

Forced and natural convection, convection correlations. Radiation, black surfaces, emissivity, simple configurations.

Overall transfer of heat, extended surfaces. Heat exchangers.

Review of basic concepts, property relations, gas mixtures, psychrometry with applications to air conditioning systems.

Review of the Second Law of Thermodynamics, Kelvin-Plank and Clausius statements, corollaries, thermodynamic temperature, Carnot cycle, exergy and its application.

ME312 Mechanical Engineering Design 3A - 10 credits (ECTS 5)

Semester 1: Prof D Nash (R), Mr C Johnstone, Mr C Cameron

Educational Aim: This module aims to provide students with experience in applying engineering science principles in a design context. It is the aim of this class to have students experience the application of knowledge, gained primarily from previous classes, to the initial stages of the design process including product design specification, concept generation and selection, and performance analysis of a candidate design solution.

Syllabus: The module will teach the following:

The class consists of a semester-long group design exercise. Over the 12 weeks of the semester, the groups will develop their design from the conceptual stage to final detailed design. There is an

initial assessment for 25% at week 6 when the product design specification is consolidated and resulting concepts that have been generated are evaluated. A group portfolio of the design, detailing its background and genesis will be submitted in week 12, along with the Peer Marking sheets.

ME313 Mechanical Design 3B - 20 credits (ECTS 10)

Semester 2: Prof D Nash (R), Mr C Johnstone, Mr C Cameron

Educational Aim**:** This module aims to provide students with experience in manufacturing, testing and optimizing the performance of an engineering system that they have designed previously in the prerequisite class ME312.

Syllabus: The module will teach the following:

The class consists of a semester long build/test group exercise, the design stage having been completed in the prerequisite class ME312. Over the 12 weeks of the semester, the groups will build, test and optimise the design they produced in class ME312. Final assessment will be based on an operational demonstration of their manufactured design to their academic supervisors. A group portfolio of the design, describing its final, practical realization will be submitted in week 12, along with the Peer Marking sheets.

ME415 Strategic Analysis of Engineering Business Case Studies - 10 credits (ECTS 5)

Semester 1: Prof D Nash (R), Dr C Walker, Prof J McKelvie, Industrial Mentors

Educational Aim: The class is intended as an introduction to the concept of the conscious pursuit of competitive advantage by business.

Syllabus: The module will teach the following:

The class will meet weekly for 3-hour periods in semester 1. Attendance at all meetings of the class is a mandatory condition of the award of the credits for the class. The initial weeks of the first semester will consist of introductory lectures, demonstration of case study techniques and introduction to mentors. Students will work in groups before the meetings in the following weeks to analyse and prepare for presentation, engineering business case studies from a selection of sources. Each student will present an analysis of their own aspect of the case. A discussion of the presentation will ensue, moderated by industrial mentors, who will award a group mark for the case analysis and an individual mark for each presentation. Students will grade each other with the peer marking form and this grading may modulate individual marks.

ME416 Engineering Ethics - 10 credits (ECTS 5)

Semester 2: Prof J T Boyle (R)

Educational Aim**:** This class follows the approach outlined for the teaching of Engineering Ethics recommended by the Royal Academy of Engineering. The study of engineering ethics within an engineering course helps students prepare for their professional lives. A specific advantage for engineering students who learn about ethics is that they develop clarity in their understanding and thought about ethical issues and the practice in which they arise. The study of ethics helps students to develop widely applicable skills in communication, reasoning and reflection. These skills enhance students' abilities and help them engage with other aspects of the engineering programme such as group work and work placements.

Syllabus: The module will teach the following:

A Case Study approach, using interactive group sessions is adopted. Student flexibility in choice of Case Studies is an important feature of the Class. As such, the syllabus broadly covers:

Awareness of issues, obligations and responsibilities; sensitising students to ethical issues. Resolving practical problems; enabling students to identify ethical issues and to examine and weigh up opposing arguments. Reflection and critique of ethical issues; consolidation of ethics skills and practice; specialist study. Further reflection and critique of ethical issues.

Fourth Year

Year Adviser: Dr M A Wheel (all class enquiries to be directed to Registrars (R))

NOTE: YEAR 4 PROJECT CO-ORDINATOR IS PROF J T BOYLE

16402 (*16460, 16464) Case Studies in Engineering - 10 credits (ECTS 5)

Semester 1 and 2: Prof M Stack (R), Dr G Rasool, Guest lecturers

*NB: Alternative codes for incoming exchange students only: 16460 Sem 1, 16464 Sem 2 (5 credits)

Educational Aim: Professional engineers need to have an awareness of the impact of engineering and technology on society. The class aims to highlight this by taking case studies from the whole spectrum of engineering industries.

Syllabus: The module will teach the following:

- important engineering achievements
- look at examples of product design
- investigate failure analysis

Examples will be taken from the bio-medical, energy (including renewable), oil & gas, aerospace and civil field and will cover project management, technical sales, planning and industrial relations as well as the more traditional topics. Full use will be made of visiting professors as well as senior representatives from industry.

16429 Computer Aided Engineering Design - 20 credits (ECTS 10)

Semester 1 and 2: Prof Y Zhang (R), Dr. T Comlekci, Dr. H Chen, Dr. B Keating

Educational Aim: This module aims to provide an appreciation of computer aided design, analysis and simulation methods over a range of engineering problems and to provide practical experience of the use of industry standard engineering simulation and analysis software to design and investigate the behaviour and performance of specific systems or components.

Syllabus: The module will teach the following:

Section 1

Introduction to geometric modelling technology and associated computational geometry. A study of data exchange issues related to analysis and simulation. An examination of rapid prototyping and rapid tooling. An overview of sensitivity studies and shape optimisation using an integrated analysis system. An insight into the analysis and simulation of plastic and composite components.

Section 2

Engineering problem solving using finite element analysis applied to a range of practical and industrially relevant stress analysis and heat transfer problems. Expanded usage of finite element analysis in linear elastic, non-linear and dynamic problems. Solid modelling, selection of boundary conditions, practical modelling, verification of models and analysis, post-processing and checking of results. Model optimisation. Case studies.

Section 3

Analyse, using CFD, an external turbulent flow and provide hand-written validation data to support the numerical solution.

ME403 (*ME406) Engineering Materials Selection - 10 credits (ECTS 5)

Semester 1 and 2: Dr A Galloway (R), Dr P Munoz-Escalona

*NB: Alternative code for incoming exchange students only: ME406 Sem 1 (5 credits)

Educational Aim: It is necessary for engineers to be aware of the importance of materials selection in the design process. This module aims to review the classes of available engineering materials, with some background to the underlying factors that determine their general properties. An introduction to the philosophy of materials selection in design will be given.

Syllabus: The module will teach the following:

This module will introduce an alternative approach to the traditional teaching methods of materials selection, which, in the past, developed an understanding of the physical and chemical nature of materials as a means of providing an understanding of their usefulness in Engineering Design.

This new approach starts at the other extreme by considering the classification of materials provides an overview of their general or specific properties and provides an insight into their uses and selection criteria. This allows for the development of a more progressive understanding of the importance of materials selection in the design process.

ME404 Energy Systems Modelling - 10 credits (ECTS 5)

Semester 2: Professor J Clarke (R)

Educational Aim: The aim of this class is to introduce students to the assumptions and limitations that underlie state-of-the-art modelling methods as presently used to appraise the performance of buildings, their associated environmental control plant, and renewable energy technologies suitable for deployment at the urban scale. Essentially, the class describes mathematical models for the underlying heat and mass transfer processes, along with numerical methods by which these process models may be conflated to form an integrated simulation program. Finally, the range of possible applications of integrated energy simulation in practice is explored.

Syllabus:
Introduction: the need for simulation, types of energy system, energy transfer mechanisms, dynamic modelling techniques, performance assessment criteria.

Boundary conditions: weather parameters, severity assessment and radiation prediction.

Integrative modelling techniques: response function and numerical methods.

Numerical simulation – buildings: discretisation, conservation equations, domain equations linking, imposing control and solving simultaneously the whole-system equation-set.

Numerical simulation – energy supply plant and control: HVAC and renewable energy conversion systems, control systems.

Numerical simulation – air, moisture and electricity flow: nodal network approach and computational fluid dynamics.

Convection heat exchange: buoyancy driven and forced convection at internal and external surfaces.

Radiation heat exchange: Long- and short-wave radiation at external and internal surfaces.

Modelling issues: Validity, applicability, user interfaces, use in practice, performance assessment method, uncertainty.

Tutorials: These will cover specific examples of the knowledge and theory that will comprise the final examination.

Private Study: Students are invited to deepen their learning by studying the material at www.esru.strath.ac.uk/courseware.

ME405 Heat and Flow 4 - 10 credits (ECTS 5)

Semester 1: Dr T Scanlon (R)

Educational Aim: An understanding of heat, mass and momentum transfer processes is a basic requirement for practising engineers. This class aims to build upon the students' previous exposure to the basic energy transfer mechanisms of conduction, convection and radiation so that multi-dimensional, steady state and transient problems can be recognised and analysed.

Syllabus:
Eulerian, Lagrangian viewpoints; derivation of mass, momentum, energy and species conservation equations for differential control volume, description of terms in equations.

Conduction: General conduction equation. One-dimensional conduction with heat generation. Extended surfaces. Unsteady conduction.

Convection: the convection boundary layers. Order of magnitude analyses; important dimensionless groups; elementary solutions of governing equations; heat and mass transfer analogy; laminar forced convection on a flat plate; Reynolds analogy, introduction to turbulence; external and internal flows; free and forced convection correlations.

Radiation: black and grey body concepts. View factors. Analysis of simple geometric configurations. Total radiation leaving a surface, radiosity, irradiation.

ME410 Aerodynamic Performance - 10 credits (ECTS 20)

Semester 1: Dr M Stickland (R), Dr I Taylor, Prof A Heyes

Educational Aim: This module aims to introduce students to the principles of experimental aerodynamics and theoretical aerodynamics. The course also provides an introduction to the importance of aeroelastic phenomena on aerodynamic design. Various aeroelastic phenomena will be introduced, with both static and dynamic problems investigated for a range of applications. The aim is to provide students with an understanding of the importance of understanding the aerodynamic flow field and its importance in the design process, and the interaction of the aerodynamic loading with the structure. A range of analysis techniques will be used to develop an understanding of the aerodynamic performance of aircraft and industrial aerodynamic problems.

Syllabus: The module will teach the following:

- Experimental aerodynamics and the assessment of the accuracy and the repeatability of the data acquired
- Programming in NI labview.
- Supersonic and transonic aerodynamics of aircraft
- Aerodynamics of road vehicles.
- Aeroelasticity fundamentals – static and dynamic aeroelastic phenomena; resonant and self-excited oscillations.
- Wing divergence and control reversal.
- Flutter - Classical coupled flutter; stall flutter.
- Bluff body aeroelasticity – Vortex induced vibration; galloping.

ME414 Advanced Mechanics & Dynamics - 20 credits (ECTS 10)

Semester 1 and 2: Dr M Wheel (R), Dr Z Wu

Educational Aim**:** The aims of this module are twofold:-

- to develop the students' ability to apply analytical techniques to the solution of engineering problems where dynamic behaviour is important.
- to provide practical experience in designing lightweight structures to ensure that they have sufficient strength and stiffness to prevent failure, particularly by buckling, when in service. This experience will be obtained by undertaking an aerospace themed or similar design, construct and test activity.

Syllabus**:** The module will teach the following:

Fundamentals of the analytical approach to the behaviour of dynamic systems.

Kinematics of particles and rigid bodies in 3 dimensional motion. Angular momentum; momentum equations of motion. Gyroscopic motion. Generalised displacements and forces, concepts of virtual displacement and work. Lagrange's equations for conservative and non-conservative systems. Vibration of multi-degree of freedom lumped parameter systems. Introduction to matrix methods for multi-degree of freedom system vibration. Eigenvalues/vectors; orthogonality. Vibration of continuous systems - longitudinal, torsional and bending.

Students, working in groups, will construct a standard specification BMFA (British Model Flying Assn.) Arrow class indoor aeromodel or similar lightweight structure. Its operational and structural performance will then be assessed. The design of the model will then be progressively modified to enhance performance and the expected enhancement measured through further testing. Through this exercise students will gain the knowledge and experience summarized in the learning outcomes.

ME409 Individual Project Project - 40 credits (ECTS 20) 400 hrs
ME420 Individual Project – Aerospace – 40 credits (ECTS 20) 400 hrs
ME421 Graduate Diploma Individual Project – 40 credits (ECTS 20) 400 hrs

Semester 1 and 2: Prof J T Boyle (R) and All Project Supervisors

Educational Aim: Students pursue an intensive research, development or design project under the supervision of a member of academic staff after which they write up their work in a dissertation. (For ME420, the project should be on an aerospace related topic). In addition to the dissertation each student writes a short technical paper on completion of the project. At the end of both semesters, panels of academic staff conduct oral examinations to assess each student's performance: these panels also assess the technical paper. The supervisor assesses the work separately.

Syllabus: The student will carry out appropriate research and scholarship to meet the learning outcomes.

Fifth Year

Year Adviser: Dr M Oliveira (all class enquiries to be directed to Registrars (R))

NOTE: THE PASS MARK FOR LEVEL 5 CLASSES IS 50%

16565 Engineering Composites - 10 credits (ECTS 5)

Semester 2: Prof J Thomason, (R), Prof M Stack

Educational Aim: The promise claimed for new materials in engineering is most likely to be realised through the use of composites and ceramics. This class aims to give a basic understanding of modern composite materials and an appreciation of predictive modelling and design implications when composites are applied to engineering structures. The main composite manufacturing processes will be outlined.

Syllabus: The module will teach the following:

Classification and definition of composites; properties of fibres and matrices; micromechanics – elastic properties of lamina with unidirectional and random long fibre reinforcement; short fibre composites; macromechanics – constitutive relations for lamina and laminates; strength concepts and prediction; failure criteria; applications to load bearing structures; – tribology of composites; exposure to aggressive environments e.g. high temperatures.

16587 Pressurised Systems - 10 credits (ECTS 5)

Semester 1: Prof D Nash (R)

Educational Aim: This module aims to introduce the subject of industrial Pressurised Systems and ensure competency in the use of Standards and Design Codes. Pressurised Systems are inherently dangerous since they contain stored energy which must be carefully controlled.

The class aims to set down a methodology whereby a range of pressurised components (spheres, cylinders, cones, etc.) can be designed, manufactured, installed and operated to a high degree of safety.

Syllabus: The module will teach the following:

Provide a basic understanding of the behaviour of components used in pressure and storage containment. 30% of the class is devoted to a fundamental development of the appropriate stress analysis of thin shells, including spheres, cylinders, cones, etc. under pressure, temperature and local loadings; discontinuity analysis is employed to derive the forces and moments that arise at nozzle/shell, shell/head junctions, etc.
The remainder of the class uses the ideas developed above to examine design methodologies established in the British/American and EU Pressure Vessel Design Codes. In these, ‘design by rule’, ‘design by analysis’, stress categorisation - primary and secondary stresses and peak stresses are explored. These are applied to the design of pressure and storage vessels of various geometries, treatment of local loads, openings and branches, supports, heads and the design for external pressure loading and stability and design for fatigue.

The syllabus is as follows:
An introduction to the design philosophy and the manufacture of pressurised systems. The stress analysis of thin shells including cylinders, cones and spheres under pressure and temperature. Pressure vessel design: British and American Design Codes, design by rule, design by analysis. Stress categorisation - primary and secondary stresses, peak stress. Applications to the design of pressure vessel components, cylindrical and spherical pressure vessels, treatment of local loadings, openings, supports and heads. External pressure loading, buckling and stability. Local loads, supports and fatigue assessment. Simple piping systems design. Use of computer packages for pipework and pressure vessel design.

16599 Aerodynamic Propulsion Systems - 10 credits (ECTS 5)

Semester 2: Dr I Taylor (R)

Educational Aim: This module aims to provide an understanding of the principles of propulsion systems for aircraft and rockets. Throughout the course, the overall procedure and methodology for designing a propulsion device, starting from the aircraft concept and the associated engine requirements, through to the aero-thermal design of engine components is presented and discussed. Using a combination of lectures and project based activities, students will develop an understanding of the overall design process and the performance of aerospace propulsion systems.

Syllabus: The module will teach the following:

Introduction –

- the various types of propulsion systems,
- historical development of gas turbine power units for jet propulsion.

The general thrust equation
Propulsion performance characteristics
Aerothermodynamics of

- intakes,
- combustors and
- nozzles –
- compressible flow governing equations,
- nozzle flows,
- subsonic and supersonic intakes,
- combustion chamber and afterburner design.

Analysis of jet propulsion power units –

- the ram jet,
- pure turbojet,
- by-pass turbojets,
- turbofan engines and
- prop fan engines.

Design of axial flow compressors and turbines, free vortex designs
Off-design Performance
Rockets

ME505 Machine Dynamics - 10 credits (ECTS 5)

Semester 1: TBC (R) **MODULE NOT ON OFFER 2015/16**

Educational Aim: This module aims to cultivate an analytical approach to the dynamic problems which occur in conventional and modern machines from piston engine systems to autonomous system control with a view to developing good design and control practice and analytical skills. The course focusses on the dynamics and control of rotating components and machines both in 2-dimensions e.g. wind turbine dynamics and control and 3 dimensions e.g. spacecraft attitude dynamics and control. The course involves using complex numbers, linear algebra and ordinary differential equations to solve practical engineering problems.

Syllabus: The module will teach the following:

- Introduction to machine dynamics.
- Mathematical preliminaries of rotating mechanisms.
- Out of balance and balancing of rotor-dynamic machines.
- Out of balance and balancing of reciprocating machines.
- Passive and active control of low-dimensional systems (rotations in the plane).
- Passive and active control of High-dimensional machines (spatially rotating machines) such as autonomous underwater vehicles and spacecraft.

ME507 Machinery Diagnosis and Condition Monitoring - 10 credits (ECTS 5)

Semester 1 and 2: Dr I Trendafilova (R), Dr G West, Dr V Caterson

Educational Aim: Condition monitoring and fault detection in structures and machinery plays an important part in the maintenance and protection of equipment, and has come to the fore since the recent advances in computer-based systems. The aim of the class is therefore to provide an understanding of maintenance and Condition Monitoring (CM) and its relevance to industry. This is achieved by studying different maintenance strategies, CM and integrity assessment techniques, the instrumentation and their utilization, and how they are applied. Particular attention is paid to vibration-based health monitoring and signal (time series) analysis.

Syllabus: The module will teach the following:

The basic idea of health monitoring and CM of structures and machines. Some basic techniques. Study of periodic and random signals, probability distribution, statistical properties, auto and cross correlation and power spectral density functions of commonly found systems, spectral analysis. Fourier transform: the basic idea of Fourier transform, interpretation and application to real signals. Response of linear systems to stationary random signals: FRFs, resonant frequencies, modes of vibration. Introduction to vibration-based monitoring. Machinery CM by vibration analysis: use and selection of measurements, analysis procedures and instruments. Typical applications to rotating machinery. Some other health monitoring techniques: acoustic emission, oil debris and temperature analysis. Applications.

ME511 Mathematical Modelling in Engineering Science - 10 credits (ECTS 5)

Semester 2: TBC (R)

This module is designed to provide insights into generic problems in Engineering Science through the use of ordinary differential equations. Mathematical modelling will be presented as an important tool for Engineers to understand complex phenomena and to predict the behaviour of complex systems. The development of key topics in differential equation theory will be cast in the context of real problems in Engineering Science. An example is the use of bifurcation methods to understand buckling. Since the main goal of the class is to explore the relationship between mathematics and real phenomena, simple differential equations are used for illustration to avoid excessive mathematical complexity. This course requires a strong mathematical ability and understanding.

Syllabus:

- Engineering Science: Overview of common themes in Engineering Science.
- Applied mathematics: Review of required mathematical methods.
- Mathematical modelling: Models, assumptions, scaling and real data.
- Linear systems: 1st and 2nd order linear ODEs with applications, phase space methods.
- Non-linear systems: Non-linear ODEs with applications, simple prototype equations.
- Stability: Classification of fixed points, linearization, Lyapunov methods, limit cycles.
- Bifurcations: Bifurcation in simple prototype equations, application to buckling.
- Perturbation methods: Regular and singular, application to fluid boundary layers.
- Chaotic systems: Routes to chaos, chaotic systems in Engineering Science.

ME512 Spaceflight Mechanics - 10 credits (ECTS 5)

Semester 1: Dr M Vasile (R)

Educational Aim: This class is designed to provide a comprehensive overview of spaceflight mechanics, including both orbit and attitude dynamics. The two-body problem will be solved from first principles to allow the solution of the two-body position-time problem. This analysis will then be used to investigate various modes of orbit transfer. Attitude stabilisation will be investigated for both spin- and 3-axis stabilised spacecraft. Finally, the various elements of the class will be brought together to illustrate the mission analysis and design process.

Syllabus: The module will teach the following:

- Dynamical Systems: Review of the basic concepts and methods of kinematics and dynamics.
- Two-Body Problem: Full solution of two-body position-time problem.
- General perturbation theory: perturbed two body motion
- Basics of N-body dynamics
- Orbit Transfer: Use of impulse and low thrust manoeuvres for two-body orbit transfer.
- Attitude Stabilisation: Analysis of spin- and 3-axis stabilised spacecraft.
- Mission Analysis and Design: Application of spaceflight mechanics to mission design.

ME514 Advanced Topics in Fluid Systems Engineering - 10 credits (ECTS 5)

Semester 2: Dr Y Zhang (R), Dr T Scanlon

Educational Aim: Complex and interesting fluid flow and heat transfer problems are central to many advanced fluid engineering systems often at the cutting-edge of modern engineering. These include human biological flows, multiphase flows, micro and nano scale flows. In all of these our physical understanding is limited, which limits our engineering design ability. This class will give students the opportunity to identify and explore a number of advanced topics in heat transfer and fluid flow. We will investigate the limitations of current engineering knowledge and the new approaches that engineers are seeking to develop. Where appropriate, computational fluid dynamics techniques will be used to explore some advanced modelling approaches and to carry out simulations of complex fluid systems. The range of flow systems the students will encounter may include (in addition to those mentioned above): refrigeration and power systems, high speed flows important for modern air- and spacecraft design, nanotech desalination and water purification, and flows encountered in urban environments and structures.

Syllabus: Up to four topics selected from the following will be explored:

- Multiphase flows
- Phase change heat transfer (boiling, condensation, melting, solidification)
- Micro and nano flows
- Very-high-speed aerodynamics
- Wind effects on structures
- Turbulence
- Microdroplet technology
- Computational fluid dynamics

ME515 Finance for Mechanical Engineers - 60 credits (ECTS 30)

Semester 1 and 2: Dr I Taylor (R)

General Aims: To give a broad understanding of accounting and finance and an appreciation of the role of these disciplines in an engineering context.

Syllabus: The module will teach the following:

Finance and accounting classes will be selected from a range of modules as agreed by the Department of Finance and Accounting and the MAE UG course director.

Syllabus for the ME515 module will depend on the chosen classes.

ME517 Spaceflight Systems – 10 credits

Semester 2: Dr M Macdonald (R), Visiting Lecturers

Educational Aim: This class is designed to provide a comprehensive overview of spaceflight systems. An overview of the complete spacecraft lifecycle from proposal, through delivery and operations is covered, along with the function and purpose of the spacecraft sub-system level components. In addition to the technical detail of spaceflight systems, the importance of ancillary skill-sets is introduced such as project management. Finally, the various elements of the class will be brought together through the production of competitive proposals for a typical spaceflight system development program.

Syllabus: The module will teach the following:

1) Spacecraft (sub-)systems
2) Spacecraft design and trade-offs
3) Spacecraft operations
4) Spaceflight systems lifecycle
5) Proposal writing, production and presentation

ME520 Advanced Research Project A – 10 credits

Semester 1: Dr A McLaren (R) and Supervisors

Educational Aim: The object of the project is to expand and enlarge on work completed in the 4th year Individual Project, in order to carry out a feasibility study for the preparation of a full paper for submission to a refereed engineering journal. Students who have performed well in their Individual Project, may be registered for this class in first semester of 5th year. Satisfactory completion of this class by December is a condition of registration for the follow-up class ME521 Advanced Research Project B, in which a full paper will be prepared for submission by April.

Syllabus: The student will carry out appropriate research and scholarship to prepare a feasibility study and project plan.

ME521 Advanced Research Project B – 20 credits

Semester 2: Dr A McLaren (R) and Supervisors

Educational Aim: The object of the project is to expand and enlarge on work completed in the individual 4th year project, in order to prepare a full paper for submission to a refereed engineering journal. This may involve further research and background study, further experimental and/or simulation work, more detailed analysis and discussion of results, or other activities, to be agreed by the individual supervisor. The full paper will be prepared by the student, under supervision, in the correct format for submission to the chosen journal. In exceptional circumstances, work carried out during a university based summer research internship may be written up for submission of a journal paper.

Syllabus: The student will carry out appropriate research and scholarship to prepare a paper for submission.

ME523 Polymer and Polymer Composites – 10 credits (ECTS 5)

Semester 2: Dr L Yang (R)

Educational Aim:
Polymer and polymer composite materials have been increasingly used in the modern engineering applications such as aerospace, automotive, construction, marine, oil and gas. This class aims to provide background knowledge of polymer and a basic understanding of modern polymer composites. The class will be balanced between science and engineering in the main subjects and prepare the students for further advances in the field of polymer and polymer composites.

Syllabus: The module will teach the following:

Polymer Chemistry and Physics
- Introduction to polymer synthesis and definitions including average molar masses and distributions.
- Physical structure and properties of polymer in solid state: morphology, melting and crystallisation, glass transition, rheology and mechanical properties, viscoelasticity and its modelling, structure-property relationship.
- Physical characterisation and mechanical testing including thermal analysis, X-ray diffraction, tensile testing (strength, stiffness and yielding), and dynamic mechanical analysis.

Polymer Engineering
- Polymer forming technology: melt flow, solidification, extrusion, injection moulding, blow moulding, thermoforming, compression and transfer moulding.
- Structure-process-property relationship

Fibre Reinforcement for Engineering Polymer Composites
- Introduction to typical reinforcement fibres for modern polymer composites: glass fibre, carbon fibre, natural fibre, aramid fibre and polymer fibre.
- Fibre manufacturing technology with focus on glass and carbon: raw materials, composition, and manufacturing processes for different products.
- Role of surface modification in the applications of glass fibre and carbon fibre reinforced polymer composites: coupling agent, sizing, and surface oxidation.
- Fibre characterisation: strength, stiffness, and statistical analysis of fibre strength.

ME526 Engineering Plasticity – 10 credits

Semester 1: Prof D Mackenzie (R)

Educational Aim:

This module aims to introduce concepts in Engineering Plasticity in metals and their application to problems in Engineering Design and Structural Integrity Assessment. The course will introduce students to basic concepts in plastic deformation, including local and structural failure mechanisms, through one-dimensional analytical models. These will then be expanded to three dimensions, introducing stress and strain tensors and multiaxial yield criteria. Students will gain insight into the elastic plastic response and failure of metallic structures through analysis of generic engineering components amenable to analytical solution, including bars, beams, cylinders and spheres.

Syllabus
The module will teach the following:

Elastic and Plastic Deformation of Metals; Elastic-Plastic Strength Data and Material Models; Basic Concepts in Elastic-Plastic Stress Analysis, Bar Structures; Elastic-Plastic Beam Bending, 3D Stress and Strain Tensors; Multiaxial Yield Criteria; Elastic Plastic Deformation of Hollow Spheres; Elastic Plastic Deformation of Hollow Cylinders; Autofrettage; Monotonic Plasticity Material Models; Cyclic Plasticity Material Models; Shakedown and Ratcheting.

ME527 Introduction to Engineering Optimisation – 10 credits

Semester 2: Dr E Minisci (R), Prof M Vasile

Educational Aims:
This module aims to provide an introduction to optimization techniques for continuous problems and to the approaches to formulate and solve optimization problems in engineering. Using a combination of lectures and project based activities, students will develop an understanding of the overall design optimisation process and the performance of different optimisation algorithms, when applied to solve real engineering cases.

Syllabus: The module will teach the following:

Introduction
- Definition of optimisation process
- Overview of real problems
- Brief classification of problems and optimisation algorithms
- "No Free Lunch" theorem

Problem formulation
- Single objective problems
- Multi-objective problems

Optimisation algorithms and applications
- Optimisation theory
- Local optimisation algorithms without and with constraints
- Global optimisation algorithms without and with constraints

Available software libraries

Approaches to handle expensive numerical models

ME528 Control Systems Design – 10 credits (ECTS 5)

Semester 2: Dr C Maddock (R)

Educational Aim:
- Examine advanced techniques for system identification and analysis of time-invariant, discrete and continuous-time linear systems
- Introduce nonlinear systems and the complexity in system design and analysis
- Implement methods for determining the stability of a linear system and introduce methods for examining the stability of non-linear systems
- Gain practice in developing computer models for linear systems and determining appropriate control techniques
- Introduce optimal control theory and methods for solving optimal control problems

Syllabus: The module will teach the following:

- Discrete and continuous models; Laplace transforms; z transforms
- Lyapunov stability; Routh theorem; root locus method; Nyquist stability analysis
- Bode plots; pole placement via state feedback and dynamic output feedback
- Controllability and observability; observer design
- PID controllers
- Simulation and analysis using Matlab/Simulink including developing control laws
- Introduction to optimal control theory (optional)
- Lag, lead and lag-lead compensation (optional)

ME519 MEng Group Project – 40 credits
ME525 MEng Group Project – Aerospace – 40 credits

Semester 1 and 2: Dr A McLaren (R), and Supervisors

Educational Aim:
This module aims to give students an authentic experience of managing and contributing to a complex group project (of an aerospace nature for ME525). This will include an opportunity to demonstrate mastery of the technical aspects of the project, in addition to demonstrating competence in project management, technical risk management and safety risk assessment.

Syllabus:
Students will form into groups and be allocated a project topic (specifically of an aerospace nature for ME525), supervised by a member of staff. All students will take part in intensive workshops on project management, technical risk management and safety risk assessment. Each group will then write a statement of purpose detailing the deliverables and schedule for the project. This will be agreed with the supervisor, who will take on the role of client. The statement of purpose will form a contract between the group and the client.

Students will carry out the project, and report to the assessment team in December (interim presentation/report) and at the conclusion of the project (time agreed in contract). Groups will be assessed on the extent to which they have met the deliverables set out in the contract, as well as on the quality of reflection on the group process and project management experience.

Appendix 1
Departmental Safety Regulations

Emergency telephone numbers (internal): Extension 2222 (First Aid) or 3333

Emergency telephone number (external): 9/999 - Fire/Police/Ambulance

1. Safety Organisation

Health and safety within the Department is organised in accordance with the University Safety Code (Section 6.6 of the University Calendar) which should be studied by all members of staff. All members of staff will be issued with a copy of these Regulations and are required to sign a declaration stating that the Regulations have been read and understood. Supervisory staff should ensure that the attention of students is drawn to the provisions of the Safety Code and Departmental Safety Regulations.

The Head of the Department has ultimate responsibility for all health and safety matters.

Health and safety management is undertaken by the Departmental Safety Convener.

An Area Safety Committee has been formed to monitor health and safety issues within specific areas. The identities of current post-holders and their areas of responsibility can be obtained from Central Services or from the Departmental Safety Convener.

General information on any health and safety matter should be directed to the Departmental Safety Convener in the first instance.

The University's Safety Services Unit can be contacted on Ext 2726.

2. Departmental Safety Committee

A Departmental Safety Committee has been appointed consisting of at least three persons representative of the main groups of staff working in each area and include, where appropriate, at least one student. The Departmental Safety Convener convenes the meetings of the Departmental Safety Committee and acts on its behalf as necessary.

3. Fire

In the event of a General Fire Alarm the procedure is set out in the Fire Regulations posted at every floor of the James Weir Building and any other building you may occupy. Read these carefully and check from time to time for any changes which may be made.

- Fire drills will be held at least once per semester.
- Know the meaning of the audible fire alarms.
- Know every escape route in the building.
- Exit by a different route at each drill.
- Note locations of fire extinguishers - all are clearly marked.

In the event of a fire being discovered:-

- Leave the room, close the door and raise the alarm by activating the nearest "break-glass" fire alarm call point and informing the security wardens (Ext 2222 or 3333).

- If it is safe to do so, use an appropriate fire extinguisher to attack the fire. Do not use water where electrical equipment or flammable liquids are involved.

- In the case of laboratory fires, if it is safe to do so, switch off all electrical and fuel supplies to the equipment involved or, if necessary, to the entire laboratory.

- Do not store combustible materials on or near electric heaters.

- Do not accumulate waste material.

- Keep litter bins covered.

- Keep fire exits clear of obstructions

4. Accident or Illness

Emergency Telephone Numbers - Extension 2222 or 3333

- If possible give immediate assistance to the patient. General First-Aid Guidance notes are contained in all First-Aid boxes. A First Aid box may be found in all of the Departmental Laboratories.

- Get help of colleagues.

- Telephone 2222 or 3333 giving own name and department, exact location (building, floor, room number) and nature of incident.

- Say if a doctor is required.

- Do not move the patient from reported position (unless obviously necessary to avoid further injury) until the arrival of the ambulance services.

- The patient should be accompanied to the hospital by a colleague.

5. Reporting of Accidents and Dangerous Occurrences

All accidents and dangerous occurrences, however apparently trivial, should be reported to the member of staff in charge or to the technician in charge of the laboratory. The Convener of the Area Safety Committee should also be informed.

An official Accident or Occurrence Report Form S.1 should be completed for all accidents and dangerous occurrences and sent to the University Safety Officer via the Convener of the Area Safety Committee. Should an incident result in hospital attendance, the Safety Office should be informed by phone as soon as possible.

6. COSHH

Under the Control of Substances Hazardous to Health Regulations 1988 (COSHH), it is incumbent upon anyone involved in the use of hazardous materials to ensure that a safe working practice is agreed upon. No work is permitted until a RISK ASSESSMENT FORM (S20/S21) has been completed. Copies of each assessment must be lodged with the Safety Convener.

All staff and relevant students should be acquainted with the Regulations.

Copies of the approved Guidance handbook on COSHH may be obtained from the Safety Convener or the University Safety Office.

Failure to comply with the Regulations may result in that area of activity being shut down BY LAW.

7. Hazardous Operations

Work should not proceed unless a Risk Assessment has been issued and signed.

Suitable protective clothing must be worn for all potentially dangerous operations (e.g. grinding/welding) supplies of which are available from the technician in charge of the laboratory.

All areas in which special hazards exist (e.g. lasers) are clearly marked and entry to these regions is restricted to those personnel having permission to work in them. Refer to the Protection of Eyes Regulations 1974.

All hazardous materials and glassware should only be transported or carried in properly designed safety containers. Winchesters should be carried only in proper holders, not in the hand. Passenger lifts should not be used unless special precautions are taken.

8. Permits to Work

All persons, other than trained workshop staff, who wish to use machine tools, hand held tools or welding equipment, etc must have a Permit to Work signed by the Head of Department or his appointed Deputy and an appropriate Academic Supervisor. Permits will only be granted to persons who can show evidence of satisfactory training and relevant experience. Permit holders must liaise with the Laboratory Superintendent before using any equipment. Permit application forms can be obtained from the Departmental Safety Convener.

9. General Laboratory/Workshop Procedure

- Protective clothing and safety glasses must be worn at all times.
- Coat racks or lockers are provided and should be used for outdoor clothing (coats, scarves, etc.).
- Food and drink is not permitted in laboratories or workshops.
- Always use machine guards where provided.
- Clean tools and machines after use and deposit all scrap material in the bins provided.
- Keep litter bins covered.
- Observe and obey No Smoking signs.
- Observe and obey all warning signs.
- Horseplay is forbidden.
- When operating equipment in the laboratories, at least two people should be present. One of these should be a technician or a member of the academic staff. Where working alone is essential, the completion of a Risk Assessment must be performed and endorsed by the Laboratory Superintendent or Academic Supervisor prior to the commencement of such work.
- Avoid loose clothing, long hair and badly fitting footwear.
- Keep all chemicals in suitable storage (see under COSHH).
- Switch off all gas cylinders, water, gas and other taps when not in use.
- Keep labs and workshops tidy.

- Keep floors clean and free of oil and grease deposits.
- Do not obstruct passages, doorways or other thoroughfares.
- Keep clear of overhead lifting-gear.
- Lifting tackle should only be used by trained personnel under the overall supervision of the technician in charge and in accordance with appropriate regulations. Replace all guard rails which may have been removed to facilitate the movement of equipment.
- Do not overload electrical power points.
- Trip hazards, such as trailing cables must not run across working areas.

9.1 Office Areas

- Office areas should be kept clean and tidy and free of trailing electrical cables.
- Cables should be inspected regularly and replaced if the insulation shows signs of wear.
- Materials should not be stored on top of filing cabinets or cupboards particularly near eye level.
- Filing cabinets should be filled from the bottom to ensure stability and drawers kept closed.
- Solvents should only be used in well ventilated areas and kept clear of heat sources.

10. Access to Buildings outwith Normal Hours

See Access to University Premises (Appendix 2) and page 14 of this Handbook.

11. Supervision of Postgraduate and Project Students

Supervisors should establish a mode of working with their students such that the supervisor is aware of and agrees to, each element of work, that safe working practices are agreed and where appropriate set down on paper and that regular, active, supervision is established.

12. Visitors to Laboratories

Visitors to the laboratories who are not accompanied by a member of staff should report to the relevant Laboratory Superintendent.

Maintenance staff should report to the relevant Laboratory Superintendent before commencing work in any laboratory area.

Children under the age of 14 are not normally permitted to enter laboratories or workshops. (See Appendix 2 of this Handbook).

13. Electricity at Work Regulations 1989

All offices, storerooms, workshops and laboratories, of whatever kind, within the Department must comply with these Regulations.

It should be noted that the University's Estates Management Department is responsible for all electrical services in the University, e.g. isolators, sockets and other such fixed equipment and no one may break into the electrical system for any reason without the authorisation of the University Electrical Engineer. Persons involved in the use of, and/or responsible for the use of electrical equipment, must read the Regulations and the University's own handbook entitled "Local Rules for Electrical Safety" (November 1991), a copy of which may be obtained from the Departmental Safety Convener. Work on 'live' equipment is prohibited unless in the most

exceptional circumstances; before any such work is undertaken permission in writing must be granted by the Departmental Safety Convener.

14. General Electrical Safety

Open-bar electric fires and non-automatic kettles are not allowed in the University.

Multi-way distribution boards with 13 amp shuttered outlets may be used from a socket provided the total load does not exceed 13 amps and they are designed to BS1363. Adaptors are not permitted.

Plugs must be fitted by, and new equipment inspected by, a competent person, before being taken into service, normally by arrangement with the relevant Laboratory Superintendent. A record of the equipment must be kept (see 15 below). The Departmental Safety Convener may approve members of staff bringing in their own personal electrical equipment (except those banned items shown above), however, such items must also be included in the Departmental inventory of electrical equipment and appropriately inspected and tested (see 15 below).

All staff have individual responsibility to report obviously faulty equipment, e.g. broken plug tops, damaged cables, etc. to their supervisor or directly to the relevant Laboratory Superintendent. Equipment thought to be defective should not be used and must be reported immediately to the relevant Laboratory Superintendent. Such equipment should be removed from service until compliance with Section 15 is established. Users of equipment should regularly inspect for damage to casings, cables and plugs etc. and for loose screws.

Where specific hazards exist in laboratory/workshop areas they will be clearly marked at the direction of the relevant Laboratory Superintendent.

All persons wishing to use new or existing equipment in laboratory areas must liaise with the relevant Laboratory Superintendent before commencing work.

15. Inspection and Testing of Electrical Apparatus

All electrical apparatus is required to be inspected and tested at certain intervals. Portable electrical equipment should not be used unless it possesses an approved PAT label.

All fixed installations are the responsibility of the University Electrical Engineer.

All other equipment which can be plugged into a socket, including extension cables, etc. (and can also include battery operated equipment) is the responsibility of the Head of Department.

The Regulations require records to be kept of the maintenance, inspection and testing of all equipment in some detail for the duration of its working life. These records will be maintained centrally by the Departmental Safety Convener. Advice should be sought from the relevant Laboratory Superintendent prior to the introduction of any new electrical equipment.

16. Control of Noise at Work Regulations 2005

Loud noise at work can damage hearing therefore, measures have to be put in place to prevent or reduce risks from exposure to noise at work. It can also be a safety hazard at work, interfering with communication and making warnings harder to hear.
The Regulations require the employer to assess the risks to your employees from noise at work; take action to reduce the noise exposure that produces those risks; provide your employees with hearing protection if you cannot reduce the noise exposure enough by using other methods; make sure the legal limits on noise exposure are not exceeded; provide your employees with information, instruction and training; carry out health surveillance where there is a risk to health.

The Noise at Work Regulations 1989 have been revised and the new 2005 updated legislation comes into force on 6th April 2006 (with the exception of the music and entertainment sectors where the Regulations come into force on 6th April 2008).

1. The new Regulations require employers to take specific action at certain action values (previously called action levels). These relate to:

- the levels of noise employees are exposed to averaged over a working day or week (e.g. use of weekly exposure would be appropriate in situations where noise exposures varied markedly from day to day e.g. gardening staff using power tools on two days of the week); and,

- the maximum noise (peak sound pressure – noises due to impacts e.g. hammering, pneumatic impact tools) to which employees are exposed in a working day.

Noise levels are measured in decibels (dB) and the following new values are:

a. ***Lower exposure action values***:

- daily or weekly exposure of ***80dB*** (previously 85dB);

- peak sound pressure of ***135dB***.

b. ***Upper exposure action values***:

- daily or weekly exposure of ***85dB***;

- peak sound pressure of ***137dB***.

Exposure limit values: (these are levels of noise exposure which must not be exceeded) daily or weekly exposure of ***87dB***, peak sound pressure of ***140dB***. These exposure limit values take account of any reduction in exposure provided by hearing protection ie personal protective equipment.

2. There is a new specific requirement to provide ***health surveillance*** where there is a risk to health.
Hearing protection must now be made available where there is exposure above the new lower exposure action value (80dB).
Hearing protection must be worn and a programme of control measures (see below) implemented where there is exposure above the new upper exposure action value (85dB).
Noise assessments will require to be reviewed to take into account the changes in the action levels. (See below).
Health surveillance must be provided for all individuals, staff or students where there is a risk to health from exposure to noise e.g. employees who are likely to be regularly exposed above the upper exposure action values, or are at risk for any reason, e.g. they already suffer from hearing loss or are particularly sensitive to damage. More information on health surveillance is available from the University's Occupational Health Service. If you have any concerns regarding occupational noise induced hearing loss or tinnitus (ringing or buzzing in the ears) please contact the Occupational Health Service on extension (JA) 4824 or email occupationalhealth@strath.ac.uk

The implementation of these Regulations can be quite complex and advice should be obtained from the Safety Officer by anyone affected by them.

17. Buildings and Equipment

Building structural faults should be brought to the attention of the University's Estates Management Department.

The safety and installation of electrical equipment and the clearance of electrical faults up to the normal 13 Amp socket outlets are the responsibility of the University's Electrical Engineer who is based in Estates Management.

18. Radiation Hazards

Radiation Hazards are the responsibility of the Area Radiation Protection Supervisors. The identities and locations of current post-holders can be obtained from your Departmental Safety Convener.

19. Compressed Gas Safety

Only persons within the Department who have been specifically trained may transport, attach or detach gas cylinders from equipment. These persons will follow the University Gudance on Compressed Gas Safety (15th December 2009).

Appendix 2

Access to University Premises -

John Anderson Campus

6.7.1 The University Court has approved the following regulations to control access to premises belonging to or in the occupation of the University in order to balance the need for access on the one hand and considerations of general and personal safety (of users), security (of property), and economy (in light, fuel and security staff) on the other.

6.7.2 The normal hours of access to departmental accommodation are as follows:

Monday-Friday

Andersonian Library	(as stated in Regulation 3.5 of the University Calendar)
Computer Centre	0800-2200
	Sports Centre (as stated in the Regulations of the Centre for Sport and Physical Activity)
All other departments	0800-1800

6.7.3 Some University buildings may be open beyond 1800 hours. Nevertheless, the normal hours of access for departmental accommodation is 0800-1800 hours. Every other time is considered outwith normal working hours.

6.7.4 Saturdays, Sundays and public holidays are considered to be outwith normal hours of access.

6.7.5 Academic, senior administrative and academic related staff are granted automatic rights of access outwith normal hours of access (please see the above) to communal accommodation and departmental accommodation within the area with which they are identified.

6.7.6 Estates Management personnel are granted automatic rights of access outwith normal hours of access (please see above) to communal accommodation and departmental accommodation, normally by prior arrangement with the Head of Department or other departmental staff responsible for the departmental accommodation. However, obviously, in an emergency, for example, flood, Estates Management staff may have to enter departmental accommodation without prior notification. It is, therefore, imperative that any hazardous operations or particularly hazardous material which by necessity is left on open benches be appropriately labelled.

6.7.7 Computer Centre staff are granted automatic rights of access outwith normal hours of access to all areas where that department has computer and communications equipment.

6.7.8 University Safety Services personnel are granted automatic right of access to all University accommodation at all times.

6.7.9 Research fellows, research assistants, individual postgraduate students and members of the technical, secretarial, clerical and manual staff may be granted rights of access to communal accommodation and departmental accommodation outwith normal hours of access. Buildings may be open until 2200 hours but permission (for those who require it) to enter departmental accommodation is required from the Head of Department or their deputy. Individual undergraduate students may also be granted such rights of access through the same procedure. The levels of access available are as follows:

(1) Unlimited Access

(i) An unlimited authorisation access card (RED) must be issued by the department and signed by the Head of Department or their deputy and the person being granted access.

(ii) The department and those areas specified within it which have been authorised for entry must be stated on the card.

(iii) The card may be valid for up to one year from issue. However, the expiry date must be shown on the card.

(iv) The card is only valid if used in conjunction with an unexpired student/staff identity card or other photographic identification.

(v) The card is issued on the understanding that the cardholder has read and understood that part of the appropriate Departmental Safety Regulations pertaining to out of hours working.
(vi) Unlimited access should only be granted when considered essential by the Head of Department.
(vii) Requests for red cards for lab access must be accompanied by a risk assessment (S20 form) and signed by the project supervisor.

ANY BREACH OF REGULATIONS WILL RESULT IN IMMEDIATE CANCELLATION OF OUT OF HOURS ACCESS AND DISCIPLINARY PROCEEDINGS.

Computer Centre Access

6.7.10 RED card access needs a countersignature by Computer Centre staff as well as Head of Department signature.

Temporary Rights of Access

6.7.11 The Head of a Department or, in their absence, a deputy previously authorised by the Head of Department may, exceptionally, grant temporary rights of access to departmental accommodation, including laboratories and workshops, outwith normal hours of access for a maximum period of one year at a time to a named visitor of not less than 16 years of age in respect of an individual person deemed by the Head of Department on their own responsibility to be suitable.

6.7.12 Some departmental equipment may only, by statute, be used by persons over 18 years of age. The Head of Department must ensure the visitor granted access is fully aware of all appropriate University/Departmental Safety Regulations and Procedures including evacuation.

6.7.13 The name of the visitor granted access and a note of the duration of the access granted must be lodged with Security Control.

6.7.14 Members of staff and students who would normally need RED CARD access are exempt from this requirement when attending social functions authorised by the Head of Department, in departmental rest areas, for example, common rooms, tea rooms, etc. This exemption is only valid until 2200 hours. If it is expected that the function will continue after this time, special permission must be granted by the Chief Operating Officer. Please see Regulation 6.7.15.

6.7.15 The Chief Operating Officer may, exceptionally, grant temporary rights of access to persons other than those granted rights of access under previous Regulations for the purpose of attending specific meetings, examinations or other functions on University premises. When temporary rights of access are so granted Security Control must be notified.

6.7.16 Departmental Safety Regulations must make adequate provision for the health and safety of all persons using departmental premises outwith normal hours of access as defined in the Regulations above.

6.7.17 All persons granted rights of access who use premises outwith normal hours must inform Security Control of their intention to enter, remain in or leave the premises in order that the security staff may arrange for them to be granted access to or exit from the building concerned. They must also record their presence on the premises either by telephoning Security Control or by signing the log book at Security Control (or, in the case of the Royal College, the James Weir or Thomas Graham Building, the log book held at the James Weir Building, Montrose Street entrance) before they enter the premises. All University staff must carry a University staff identity card or other photographic identification. Students must carry a current student identification card plus the appropriate departmental authorisation (for example, BLUE or RED card). Persons using premises outwith normal hours of access may be refused entry or requested to leave by a member of the Security or University Safety Services staff if they cannot show proof of identity.

6.7.18 Security staff must check periodically the safety of individuals recorded as being on the premises outwith normal hours of access.

6.7.19 Persons using premises outwith normal hours of access must have access to a telephone in order to contact Security Control in the event of an emergency.

6.7.20 Operations outwith normal working hours which have been assessed and identified as having a particular risk associated with them must have appropriate control measures in place to handle the foreseeable consequences of the work.

6.7.21 Abuse of the system may result in confiscation of the access card and identity card by Security or Safety Services personnel.

Children - Special Access

6.7.22 Children (persons under the age of 16) are permitted to enter the office accommodation and sports and recreational facilities of the University during the normal hours of access. Access to University premises is only permitted if accompanied by a parent or other responsible adult. Outwith normal working hours, children may be allowed access to office accommodation only; they must be accompanied by the parent or legal guardian who must directly supervise the child.

6.7.23 Children are not permitted to enter laboratories or workshops or other accommodation whose sole means of access is by way of a laboratory or workshop unless for the purpose of attending a supervised course, demonstration or exhibition in which case all sources of potential hazard will have been removed or rendered safe by other means.

Pet Animals

6.7.24 Pet animals of any nature may only be brought on to University premises under extraordinary circumstances. A Head of Department, on advice from a Departmental Safety Convener, may exceptionally authorise access to department premises in which case the animal must be kept under the direct supervision of the owner or other responsible person. A guide dog accompanying a blind person will normally be permitted unrestricted access to University premises but the nature of equipment in certain areas may make it necessary to deny access to such guide dogs.

University of Strathclyde Engineering

DEPARTMENT OF MECHANICAL & AEROSPACE ENGINEERING

RED CARD FORM

PLEASE USE THIS FORM IF YOU ARE REQUESTING A RED CARD FOR AFTER HOURS WORK IN THE LABORATORIES OF THE JAMES WEIR BUILDING (6PM – 8AM MON-FRI; SAT/SUN & HOLIDAYS)

Please complete the following and make two copies. The Safety Convener will retain the original. A copy should be passed to your supervisor and one kept by yourself for reference.

Is this Red card (permission to be in the building after hours);

A) Being issued to allow the researcher to conduct non-hazardous work and/or paper work?
B) Being issued to allow the continuation of practical work (covered by your scheme of work) involving chemicals or hazardous equipment?
[If you are unclear if the latter applies, you are directed to your S20 and/or S21 form. You and your supervisor need to be clear that your after-hours activities do not pose a risk to Health as defined by section E.]

Name:……

Supervisor(s):……...

Area(s) of the building to which access is requested (floors and/or labs):

……

<u>For all persons requesting access for activities associated with A only (no partner required)</u>

In return for permission to be in the building after hours, I agree to register my presence with Security on every occasion that I work out of normal hours (6pm - 8am Mon-Fri; or Sat/Sun or when the Univ. is officially closed)

Signature ……....…… Date:……...

For all persons requesting access for activities associated with B.

In return for permission to be in the building after hours, I agree to register my presence with Security on every occasion that I work out of normal hours (6pm - 8am Mon-Fri; Sat/Sun or when the Univ. is officially closed).

It is understood that I can only work when I have a partner who is prepared to remain in the building until my activity has been completed. The onus is on me to ensure that this person has been identified prior to 6pm weekdays and 6pm Fri for Sat & Sun work or for days when the Univ. is to be officially closed.

The programme of work to be conducted will be discussed in advance and approved by my supervisor or his nominee prior to its commencement.

Signature ……..…… Date:……..

Supervisors

It is my wish that the above be provided with permission to work out of normal hours. Where the researcher has requested access to continue practical work, the programme will have been approved in advance. I understand that I have a duty of care (defined in the area safety regulations Sec. 9) to the researchers under my direction working after hours.

Signature ……..…… Date:……..

The department will not be held responsible for any accident or incident which occurs should you deviate from the above. Should you be found within the building working alone after hours on activities covered by section B your permission to work out of normal hours will be withdrawn.

Key to Buildings

See https://www.strath.ac.uk/estates/admin/roombooking/buildingcodes/ for up-to-date details.

Prefix	Building Name
AB	John Arbuthnott Building, Robertson Wing
AQ	Lord Todd Building
AR (or ARC)	Architecture Building
AT	Alexander Turnbull Building
BH	Barony Hall
CL (or CB)	Collins Building
CSR	Sports Centre
CU (or Cur)	Curran Building
CV (or Col)	Colville Building
CW	Cathedral Street Wing, Business School
GH (or P)	Graham Hills Building
HD	Henry Dyer Building
HW	Hamnett Wing, John Arbuthnott Building
JA (or K)	John Anderson Building
JW (or M)	James Weir Building
LT (or L)	Livingstone Tower Building
LH	Lord Hope Building
MC (or McC)	McCance Building
RAM	Ramshorn Building
RC (or R)	Royal College Building
SP	St Pauls Chaplaincy Centre
SW	Stenhouse Wing, Business School
TG (or C)	Thomas Graham Building
UC	University Centre
USSA (or SU)	Students' Union
WC	Wolfson Centre
WD (or DUN)	Sir William Duncan Building
EXT SYT	Scottish Youth Theatre
GCU	Glasgow Caledonian University - ARC